RAILROAD GAZETTE

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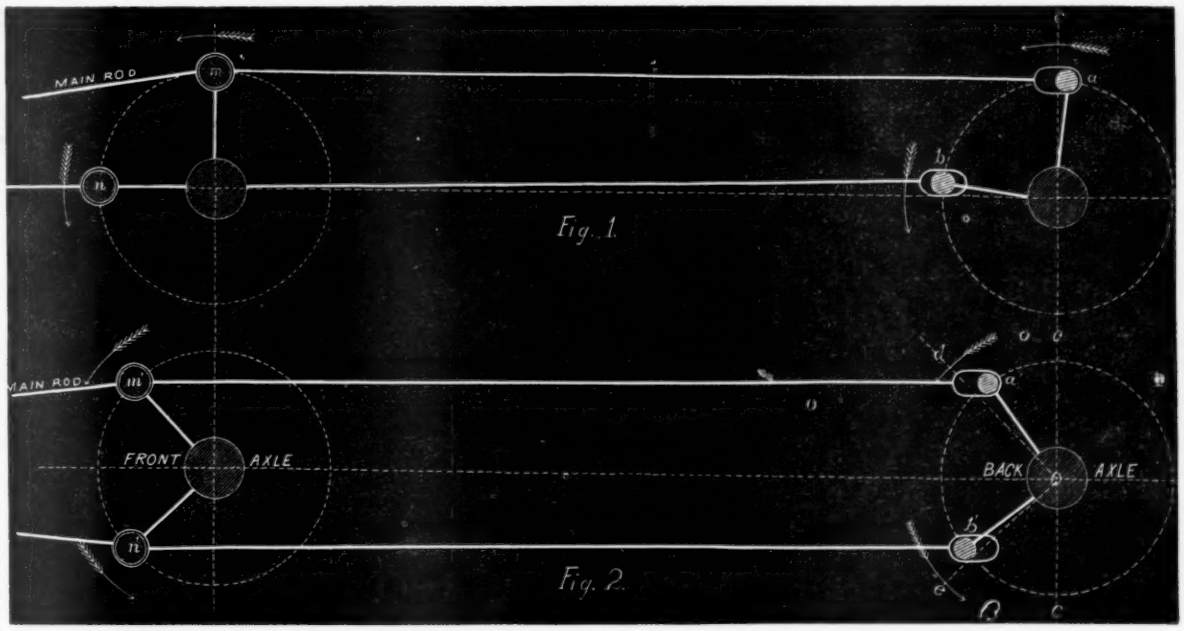
SOLID-END COUPLING-RODS.

A subscriber in Keokuk, Iowa, writes to us propounding the question, "Is there any pound on the coupling-"rods of a locomotive engine, say, for instance, the en-"gine is in train, wedges up tight, side rods *perfectly* "*loose*."

As this has been, and still is, a much disputed point, and about which great diversity of opinion exists, and which, to a great extent, will determine whether rods with solid ends can be used, we have delayed our reply to the letter until we could prepare a diagram and also an engraving of the rods which Mr. Headden, the Master Mechanic uses on the engines of the New Jersey Railroad and Transportation Company.



We have for a long time been advocates of the solid-end coupling rods with brass bushing: 1st, because they are cheaper; 2d, because they will run a long time without any perceptible lost motion; and, 3d, because we have not thought that lost motion produced what our correspondent calls "any pound."

We know that these opinions are directly opposed by many master mechanics and locomotive runners with whom we have discussed the question, and by many more with whom we have not; but we hold them nevertheless.

In order to illustrate our theory, we have had the diagrams, Fig. 1 and Fig. 2, prepared and engraved, in which the cranks are represented in two different positions. In Fig. 1, *m a* and *n b* represent the two coupling rods, which are supposed to be tight on the pins *m* and *n*, and to have lost motion in *a* and *b*. Of course, to represent the lost motion in the engraving, we have been obliged to exaggerate it very much, but that will not affect the theory. If the crank *m*, which is represented in the vertical position, is revolving in the direction of the arrow, obviously the coupling rod *m a* will pull the crank-pin *a* in the same direction. The brasses *a* will bear against the back side of the pin, and, as there is lost motion, the crank *a* will be behind the position of that occupied by *m*. By taking a pair of dividers and measuring the distance from the center of the pin *n* to that of *b*, it will be found that the latter will be very nearly in the centre of what in this case is an oblong slot, and that the brasses will not bear against either side of the pin, so that the back axle is driven entirely from the pin *a*. In Fig. 2 the cranks *m'* *n'*, are represented in a position half-way between the dead-point and the full-stroke, or at an angle of 45° from the horizontal and vertical lines. It will be observed that the brasses at *a* still bear against the pin on the same side as in Fig. 1, but that the pin *b* has approached very nearly to the front side of the slot in the brasses. It will also be noticed that the crank pins *m* and *n* have the greatest amount of horizontal movement at full stroke, which diminishes as they approach the dead points. When they stand at an angle of 45°—as represented in Fig. 2—the amount of their horizontal movements are exactly alike. At this point the brasses of the coupling-rods would bear equally against the pins *a'* and *b'*—those on *b'* against the front side of the pin, and those on *a'* on the other side—were it not that both of those cranks have, on account of the lost motion in the rods, fallen behind the position of *m'* and *n'*, so that the back axle is still driven by *a'*; and the brasses in *b'* do not bear against the pin. The horizontal motion of the crank *m'* after it passes the central position, instead of being faster will be slower than that of *n'*; therefore *n'* will "*gain on*" the pin *b'*, while *m'* will lose on *a'* after they leave the position in which they are shown, so that at some point before *b'* reaches the position of the line *e o*, the *brasses of each rod will bear equally against their pin*. Of course this will only be for a single instant, but in that time the bearing is transferred from the one brass to the other, and as they must both bear alike when the transfer is made, there can be no "pound" or thump. The case is entirely different from the action of the reciprocating parts of an engine or other machine. In a main connecting-rod of a locomotive or stationary engine, lost motion will always cause a thump, because the bearing of the brasses against the crank pins must in that case become suddenly transferred from one side of the pin to the other, whereas, with coupling rods it is gradual. If there is lost motion at each end of the road, the same action will take place as that we have described, excepting that it will occur at each end, instead of at one only.

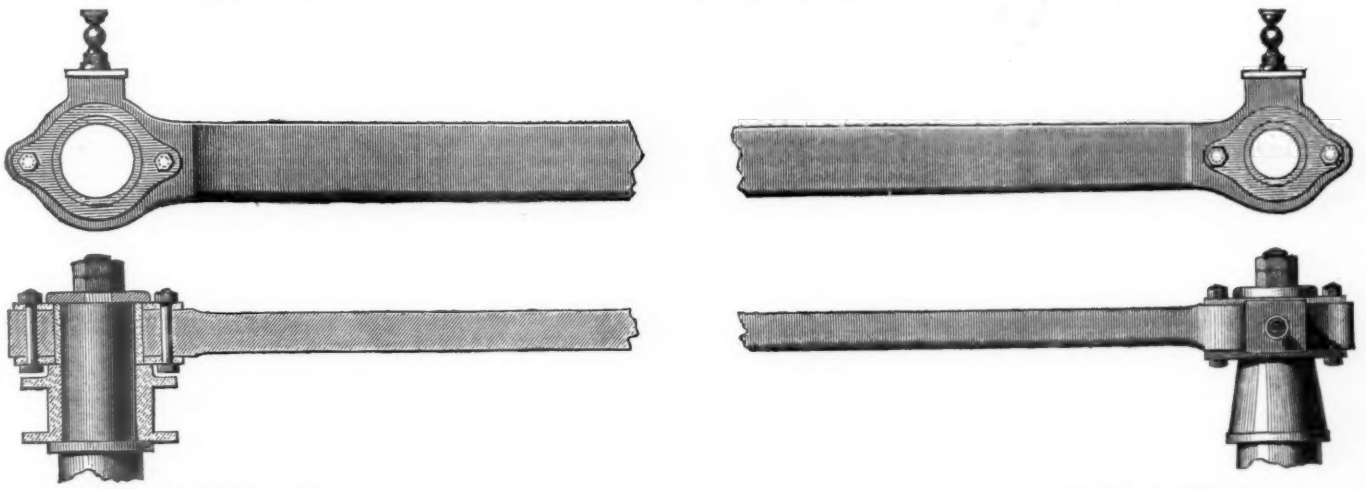
Mr. Headden has used coupling-rods with solid bushed ends for a number of years, and says, "their advantages over the adjustable center rods are:

"1st. They weigh from 45 to 75 lbs. less per rod.

"2d. They cost from $60 to $75 per pair less.

"3d. The cost of maintenance is $50 per engine per annum less.

"Their average mileage without removal of bushing is 30,000 miles. We do not change the dimensions, except the length, for engines of different distances between wheel centers.



"In renewing bushing, bush the same end of both rods to maintain absolute accuracy in length."

Some of his engines have run over 60,000 miles without requiring a renewal of the bushings.

It will be observed that the body of the rod is made heavier next the main pin than at the other end. This he was induced to do from the fact that, after carefully observing and recording the breakages, he found that out of 24 rods that broke, 23 broke within two feet of the main pin. On the principle that things break because they are not strong enough, he made the rods heavier where they broke than at the other end.

Now, that we have given our theory, and Mr. Headden's facts, what say the practical men? We would be

very glad to have some testimony on the subject from them. Write us letters no matter whether the grammar is unexceptionable or not—we will attend to that—only be sure that your facts are right. There is hardly an intelligent locomotive runner in the land who could not give us interesting facts if he would only observe carefully. Such men seldom realize how valuable a privilege it is to be able to see and record facts and phenomena with accuracy. If you tell us what you have observed and only that—not what you suppose; that seldom does us any good—and observe carefully, it will nearly always contribute useful information or suggest enquiry. Therefore, if any of our readers have anything to say on this subject, we invite them to take a sheet of paper and in the language of the immortal Crocket, "Be sure you are right, then go ahead."

What is Personal Luggage?

The following is a report of an English case involving the above question:

The plaintiff, who had come from Canada to reside in this country, traveled third-class, from Birkenhead to London, and had four large trunks, with a quantity of household linen and other luggage—blankets, sheets, towels, and clothes. The trunks were allowed to be carried as personal luggage, and no extra charge was made. One of them was lost, and for this the action was brought. The claim made was for £180—that is, £160 for value, and £20 for damage, expense of detenion, etc. The list of articles contained in the trunk included a plum cake, put at £1 10s.; a Family Bible, put at £5 10s.; a "History of Ireland," six vols., £5 5s.; a "union jack," £7 10s.; and a quantity of towels, blankets, and sheets, put at £25—but of which the value was fixed by the jury at £16. The company had paid into court £40 for the clothes; but the plaintiff persisted on his claim, and went to trial, and at the trial, before Mr. Justice Blackburn, it was objected, on the part of the company, that the trunk and its contents could not be considered as personal luggage—first, as being far in excess of the weight allowed without payment (40 lbs.), and having not been received under any obligation to take care of it: but this the learned judge overruled, as no objection had been made at the time. Next, it was objected that the articles from their nature were not such as could be considered "personal luggage," as they could not be required for the purposes of the journey. The learned judge withdrew from the case the "History of Ireland" and other articles but he left the rest of the articles to the jury; reserving the question of law as to the blankets, and sheets, etc. The jury found for the plaintiff for £22 beyond what was paid into court, and the question was now raised as to the blankets, towels, and sheets, valued at £16.

Mr. J. Digby moved, on the part or the company, to reduce the verdict by that amount, and also to set aside the verdict on the ground of misdirection as to personal luggage, which, he insisted, must be limited to such articles as might be really required for the purposes of the journey.

After a long discussion,

The Lord Chief Justice said there had been no misdirection, for the learned judge had withdrawn from the case such articles as could not come within the proper definition of personal luggage, and had reserved the question as to the rest. With reference to the Bible, it could not be said that a man might not require a Bible on a journey; and its mere size was only an element in the consideration of the question, while, as to the value, it was for the jury, and they had greatly reduced the amount. Then as to the "union jack," a man might for some reason desire to carry such an article with him, and it was a question for the jury. So, as to the cake, similar observations applied. But a man could not claim to carry as personal luggage articles of household linen or furniture not ordinarily required on a journey; and as to these articles there would be a rule to reduce the verdict according to leave reserved. As to the general point taken, that the trunks were far in excess of the amount allowed as luggage, the answer was that made at the trial by the learned judge that the objections ought to have been made at the time, and the extra charge claimed. After receiving the luggage the company could not set up the objection for the first time when the luggage was lost.

Rule *nisi* to reduce the verdict by £16.

—Representative Price, of Georgia, has introduced into Congress a bill offering 10,000,000 acres of public land in aid of the construction of the Atlantic & Great Western Canal, to connect the waters of the Tennessee River with the Coosa, to give water transportation to the Gulf of Mexico by way of that river and the Alabama, and also to connect the Tennessee with the Chattahoochee and Ocmulgee rivers, and open communication with the Atlantic seaboard.

—Butler, Pa., had a celebration over the opening of a twenty-mile railroad, and the feature was the burial of the stage coach, and a procession of Pittsburghers up the street, led by the stage driver, equipped with penny horns, jewsharps, dinner bells, gongs and fish-horns.

—The first railroad in Honduras is progressing. The first section has been leveled and the larger bridges finished. Eleven miles of rails had been laid down up to January 1st, and two locomotives were at work carrying materials.

Form of Report of Railroad Corporations.

The Massachusetts Railroad Commissioners have adopted a form of report, which every railroad company in the State is required to fill up and forward to the Board on or before the first Wednesday of November, 1871. The form, with the circular letter of the Commissioners to the railroad officers, is given below:

Gentlemen: Herewith we enclose a copy of the new form of return prepared by this Board, for the year ending September 30th, 1871. We send it at this time, as required by law, in order to give you the year's notice, so that books may be kept in accordance therewith. The Board desire to have the returns in such a shape that a clear and intelligible view of the railroads of Massachusetts, and their business, particularly in Massachusetts, may be presented. They will be obliged to you for any suggestion tending to improve the form of the return, either by additions or omissions, and and will give such suggestions careful consideration before preparing the form for the following year.

In regard to this return, it will be noticed that "the "total amount of income which has been expended in "construction, equipment, and purchase of property," is asked for. This will require, of course, research into the past records of the company, but the year will afford ample time to do it, and the Board expect that a full return will be made under this head, which, when once done, will not again require time, but will only be added to when necessary. It is, of course, known to the community, that many roads have for years made no dividends to their stockholders, but the public probably have little idea how great an amount of income has been spent for their increased accommodation, instead of being distributed among the stockholders. When income has been appropriated to completing original construction and equipment, or paying off debts incurred for that purpose, whether floating or funded, to building branches or second track, or to purchase of property, it should be returned under this head. Amounts charged off for depreciation should not be included, nor interest paid on debts; but amounts paid to sinking funds to redeem debts are to be included.

Under the head of "Cost of Road, Equipment, and Property," a slightly different classification of some items has been made, which, in some cases, will require estimates of value to be made by the officers best acquainted therewith. Some roads have been in the habit of entirely neglecting the distribution of items of cost; but this practice must be corrected for the future, and, if the statement cannot be obtained from the books, competent persons must be employed to make the distribution.

Under the head of "Description of Road," the intention is to get an intelligible statement of the actual facts of how many miles of railroad there are in Massachusetts, and how many miles have been operated to furnish the income and require the expenses reported. The former returns have been anything but clear in this respect.

The statements as to "Rolling Stock," "Miles Run," etc., are intended to be fuller than before, and a new head is introduced, "Classification of Business," which it is expected will furnish very valuable information. Perhaps you can give us valuable suggestions in regard to this subject.

In regard to charging any part of the money paid out during the year to capital account, it seems to the Board there may often be times when this is a proper course. It should be for such objects as are mentioned, and only for these under extraordinary circumstances. The gradual increase of business requires, of course, a gradual increase of equipment, buildings, and sidings, to correspond with it, which should be met from the annual income. Whatever is done more than this and charged to capital, the Board desire a clear statement in regard to it.

The classification of operating expenses has been somewhat changed from the old returns, and, it is believed, improved. Any suggestions in regard to this head will be received with pleasure. The Board are perfectly aware that on a well-managed road the items of expense are distributed much more minutely, but it is not deemed best to call for all these items in a report to the State.

If you are in doubt as to the meaning of any of the queries, or how to answer them, please communicate with the Board. On or before the 15th of September next, another copy of the return will be sent.

FORM OF REPORT OF RAILROAD CORPORATIONS, PRESCRIBED BY THE BOARD OF RAILROAD COMMISSIONERS, UNDER THE PROVISIONS OF CHAPTER 307 OF THE ACTS OF THE YEAR 1870.

To be returned to the Board on or before the first Wednesday of November, annually.

Report of the.....Railroad Company,

FOR THE YEAR ENDING SEPTEMBER 30, 1871.

CAPITAL STOCK AND DEBTS.	$
Capital stock authorized by charter	
Capital stock authorized by vote of company	
Capital stock paid in	
Capital stock paid in, per mile of road owned by company	
Capital stock paid in, proportion for Massachusetts*	
Funded debt as follows:—	
1st mortgage bonds, due , rate of interest	
2d mortgage bonds, due , rate of interest	
3d mortgage bonds, due , rate of interest	
Total amount of funded debt	
Unfunded debt, incurred for construction, equipment or purchase of property†	
Total amount of debt	
Proportion of debt for Massachusetts*	
Proportion of debt per mile of road	
Total amount of income which has been expended (in addition to funds derived from capital and debts) in construction, equipment and purchase of property.‡	
Total means applied to construction, equipment and purchase of property	
Proportion of above for Massachusetts*	
Number of stockholders	
Amount of stock held in Massachusetts	
Number of stockholders in Massachusetts	

COST OF ROAD EQUIPMENT AND PROPERTY.	
Construction of Road and Branches built by Company.	
Grading and Masonry	
Bridging	
Superstructure, including rails	
Land, land damages and fences	
Passenger and freight stations, wood-sheds and water stations	
Engine-houses, car-sheds and turn-tables	
Interest paid during construction, discount, etc	
Engineering, agencies, salaries and other expenses during construction	
Total expended for construction	
Average cost of construction per mile of road built by company	
Same per mile of single track built by company, not including sidings	
Proportion of cost of construction for Massachusetts*	
Equipment.	
Locomotives and snow-plows	
Passenger, mail and baggage-cars	
Freight and other cars	
Machine-shops, machinery and tools	
Total for equipment	
Average cost of equipment *per mile of road operated* by company	
Proportion for Massachusetts*	
Property Purchased.	
branch, original cost , purchased for	
Stock of road, shares, purchased for	
Bonds of road, nominal amount , purchased for	
Steamboat , nominal amount , purchased for.	
Lands in , not necessary for operation of road	
Total of additional property purchased	
Property in Massachusetts	
Whole amount of permanent investments	
Proportion for Massachusetts	
Amount of sinking funds on hand to meet debts	

DESCRIPTION OF ROAD.†	
Length of main line of road from to	
Length of main line of road in Massachusetts	
Length of main line of road [in other States, specifying each]	
Length of line with track laid, if road is not completed	
Length of double track on main line	
[Branches owned by company. Name and description of each, single or double track	
Total length of branches owned by company	
Total length of branches owned by company in Massachusetts, [in other States, specifying each]	
Aggregate length of sidings and other tracks not above enumerated	
Same for Massachusetts	
Total length of tracks belonging to this company	
Same for Massachusetts	
Roads belonging to other Companies, operated by this Company under Lease or Contract.	
[Name, description and length of each]	
Total length of above roads	
Total length of above roads in Massachusetts [in other States, specifying each]	
Total miles of road operated by this company	
Total miles of road operated by this company in Massachusetts	
Number of stations on all roads operated by this company	
Same for Massachusetts	

Rolling Stock.	Total No.	Per mile operated.
Locomotives (average weight of engines in working order)		
Tenders (average weight of tenders full of fuel and water)		
Snow-plows (average weight)		
Passenger cars (average weight)		
Mail and baggage cars (average weight)		
8-wheel box freight cars (average weight)		
4-wheel box freight cars (average weight)		
8-wheel platform cars (average weight)		
4-wheel platform cars (average weight)		
Other cars		

Miles run, Rate of Speed, &c.	
Miles run by passenger trains	
Rate of speed of express passenger trains, including stops	
Rate of speed of accomodation trains, including stops.	
Miles run by freight trains	
Rate of speed of freight trains, including stops	
Miles run by other trains, and for what purposes	
Total train miles run	
Number of passengers carried	
Total passenger mileage, or passengers carried one mile.	
Passenger mileage to and from other roads	
Number of tons carried	
Total freight mileage, or tons carried one mile	
Freight mileage to and from other roads	
Average rate of fare per mile (not including season tickets) received from passages on roads operated by this company	
Average rate of fare per mile received from passengers to and from other roads§	
Average rate of fare per mile from season-ticket passengers, reckoning two passengers per day to each ticket.	
Average rate of freight per ton per mile on roads operated by this company	
Average rate of freight per ton per mile to and from other roads*	
Average number of cars in passenger trains	
Average number of cars in freight trains	
Number of persons regularly employed by company	

CLASSIFICATION OF BUSINESS.	
Passengers coming from other States	
Passengers going to other States	
Passengers traveling only within this State	
Passengers to Boston (season)	
Passengers from Boston (season)	
Season-ticket passengers to be reckoned once a day each way	

* Unless some very good reason exists to the contrary, this proportion should be for the miles of road in this State compared with the whole. If you think the proportion should be made on a different basis, please state the reasons therefor.

† This item is not to include balances due other roads, unclaimed dividends, or anything connected with the ordinary operations of the road. It refers only to debts incurred for permanent investments.

* See note in preceding column.

‡ In some former reports, certain sums taken from income have been charged off for depreciation. These sums are not now to be reckoned and included under the head of "income expended in construction," etc. Depreciation should properly be charged to maintenance, not as an addition to the permanent investment.

† Lengths in the statement to be given in miles and decimals. Characteristics of road will be required in a separate report, and when once made need not be repeated from year to year.

§ After deducting all allowances for tolls, or use of cars, etc.

FREIGHT IN TONS.	Brought from other States	Carried to other States	Carried within this State only	Taken from Boston	Carried to Boston
Anthracite coal					
Bituminous coal					
Petroleum					
Iron and steel rails					
Castings and other ores					
Other metals					
Iron and other ores					
Stone and sand					
Lime and cement					
Lumber					
Live stock					
Dressed carcasses, smoked and salted meats					
Flour					
Grain					
Other agricultural products					
Manufactures†					
Merchandise†					
Ice					
Other articles					

EXPENDITURES CHARGED TO CAPITAL ACCOUNT DURING THE YEAR.

Main line, extension or alteration of road	
Branches, extension or alteration, specifying each	
Double track extension	
Land	
Passenger and freight stations, wood-sheds and water stations	
Engine-houses, car-sheds and turn-tables	
New locomotives and snow-plows	
New passenger, mail and baggage cars	
New freight cars	
Machine shops, machinery and tools	
Purchase of other roads, specifying what	
Subscriptions or loans to other roads, specifying what	
Any other expenditures charged to capital account	
Total	

EXPENDITURES ON OPERATING ACCOUNT FOR THE YEAR.

Maintenance of Way and Buildings.	
Repairs of road, exclusive of bridges and new rails (including labor and material in new sidings)	
New iron rails, deducting old rails sold	
Steel rails	
Repairs of bridges	
Repairs of buildings and fixtures	
Repairs of fences, road crossings and signs	
Removing ice and snow	
Total for maintenance of way and buildings	
Per mile of road kept in repair	
Per mile of single track kept in repair, not including sidings	
Total length of steel and steel-headed rail track now laid on the road	
Traffic Expenses.	
[To include oil, fuel, clerks, watchmen, and incidentals about shops.]	
Repairs of locomotive and snow-plows	
New locomotives and snow-plows	
Repairs of machine shops and machinery	
New machine shops and machinery	
Repairs of passenger, baggage and mail cars	
New passenger, baggage and mail cars	
Repairs of freight and other cars	
New freight and other cars	
Fuel (for cars and engines)—number of cords of wood, ——; cost	
Fuel (for cars and engines)—number of tons of coal, ; cost	
Oil and waste (for cars and engines)	
Salaries, wages and incidentals, chargeable to passenger department	
Salaries, wages and incidentals, chargeable to freight department	
Wages of switchmen, gate-keepers, signal-men and watchmen, unless included above	
Gratuities and damages, passenger account	
Gratuities and damages, freight account	
Total	
Per mile of road operated	
Per mile of single track operated, not including sidings	
Miscellaneous.	
Amount paid other companies for tolls on freight and passengers, or for use of cars, specifying each company and amount‡	
Amount paid other companies as rent for use of road, specifying each company and amount	
Telegraph expenses	
United States taxes and stamps	
State taxes	
Local taxes	
Insurance, loss by fire, and damages paid for fires set by engines	
General salaries and office expenses, law expenses, and all other expenses (except interest) not included in any of the above items	
Total miscellaneous	
Total expenditures for operating the road	
Per mile of road operated	
Per mile of single track operated, not including sidings	
Proportion for Massachusetts	

REVENUE FOR THE YEAR.

Receipts from passengers on roads operated by this company	
Receipts from passengers over other roads as toll or for use of cars	
Receipts from freight on roads operated by this company	
Receipts from freight over other roads as toll or for use of cars	
Receipts as rent for use of road	
Receipts for mails	
Receipts for express	
Total earnings	
Per mile of road operated	
Per mile of single track operated, not including sidings	
Proportion for Massachusetts	

†Manufactured articles starting from the place of manufacture, so far as known, are to be reckoned under the first head; after they have arrived at a depot for sale, they become a part of the general merchandise of the place, and on any second transit are to be reckoned under the second head.

The last two columns apply only to the roads terminating in Boston.

‡This is intended to include any allowance made other roads for the use of their cars, or any difference allowed to them between your regular fares and freight on your road, and the rates you receive for passengers and freight brought by or carried to these other roads. As this amount is charged here as an expense, the same amount must be included in the "receipts for passengers and freight," under the next head. In the case, however, of a *pro rata* division of fares and freight on several roads, constituting together a long line, the remarks as to difference of fares and freights would not apply. You will enter, however, in such case, under this head, anything allowed for use of cars, entering the same amount, also, on the other side with your receipts.

Income from other sources	$
Total income	
NET INCOME, DIVIDENDS, &C.	
Total net income above operating expenses	
Paid for interest	
Paid in dividends per cent. for the year	
Paid to sinking funds	
Balance for the year or surplus*	
Surplus at commencement of the year*	
Total surplus*	
Invested as follows: Cash and loans	
Balance of accounts due from other roads	
Other uncollected accounts	
Materials for repairs	
Fuel and stores	
Any other items	

GENERAL BALANCE SHEET AT LAST CLOSING OF ACCOUNTS.

LIST OF ACCIDENTS IN MASSACHUSETTS.

	From Causes beyond their own control.		From their own misconduct or carelessness.		Total.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Passengers						
Employes						
Others						

STATEMENT OF EACH ACCIDENT.

NAME AND RESIDENCE OF OFFICERS.

PROPER ADDRESS FOR THE COMPANY.

* In some former reports, surplus has been reported as embracing stocks and bonds, or real estate. Such amounts now are to be included under the head of "Income expended in construction, equipment and purchase of property," and the cost of each stated under the head of "Property purchased." Surplus is held to include only balance of operating accounts, not permanent investments; and unclaimed dividends, balance due other roads (if it is so), etc., are to be deducted from it, before reporting amount here. In case you have no surplus, and the balance turns out the other way, state the particulars of the deficiency.

The Causes of Railway Axle Fracture and the Remedy.

BY W. BRIDGES ADAMS.

[In this article the American reader should remember that English cars, which have no "bogies" or "trucks," are referred to.]

The fatal accident which has slain so many persons, and maimed so many more, perhaps for life, and the impossibility of ascribing blame for its occurrence to any individual or corporate body, leads us to the inquiry as to the possibility of future precaution. The contingency of one train damaging another at the moment of passing each other on two lines of rails seems at first a remote one, but of course the chances in favor of it will be on the increase with the increase of traffic, and it is therefore worth analysis.

That the breakage of the axle was caused by the gradual deterioration of material, may be assumed *a priori*, for the wagon, so far as we know, was one long in use, originally constructed to carry 6 tons, and loaded with less than that amount when the axle suddenly broke.

WHEELS AND AXLES.

In discussing the question of wheels and axles, we must define them, for there are wheels proper, and wheels so called, which are not wheels at all, but only rollers. In its principle, what is called in railway parlance, an axle and pair of wheels is, in truth, only a garden roller with the center portion cut away. If any one tries to pull a garden roller round in a small circle, he will soon find himself in the difficulty that it is a sledge, and not a rolling body, that he is working at. The garden roller is a revolving axle, with the wheel fixed fast on it, and so is the railway axle. Some long time back, an agricultural machine maker patented and made what he called a clod crusher. It was a revolving harrow, some 7 ft. in length, set all over with spikes. But no power of horses could draw it, save in a straight line. To change its course was impracticable, because both ends would persist in traveling at the same rate of speed, a practice strictly in conformity with geometry. So our would-be clod-compeller was compelled by the clods to change his practice. He divided his roller into two separate wheels, each being enabled to revolve separately on the axle. Still, each wheel was so broad that he gained little advantage. He then subdivided it into four wheels, and it was much more easily managed, and he carried on his subdivision till he had reduced his rollers to the width of ordinary wheels, all strung on one axle together. In fact, he had gone through once more all the original contrivances which had in past ages developed wheels out of a roller, and this is precisely the process to which railway mechanics must, sooner or later, address themselves. They must take to wheels proper, and eschew garden rollers, however cunningly they muy cut and carve them into fanciful forms, conical or other, for it is a law of nature that, to avoid friction, wheels must travel at different rates of speed along pathways of differing lengths.

It is recorded that when Donald McDonald first descended from the Highlands and beheld a four-wheeled carriage traveling along with a Lowland earl, he first stared with astonishment, then burst into a fit of laughter, exclaiming, "Weel rinnit, wee wheel, big ane canna catch ye," not realizing the fact that the big wheel made fewer revolutions.

It is quite true that by making, in railway practice, each half of the garden-roller the frustrum of a cone, it is possible so to vary the diameters as to be the equivalent to separate wheels, provided sufficient endlong movement of the axle be arranged. But this only holds good as regards a single axle, and vehicles with a single axle are not prevalent on railways; they have never less than two, and sometimes more. The frames to which these axles are attached are oblong, and the axles are supposed to be rectangular to the frame, and parallel with each other, the line of traction being parallel with the planes of the so-called wheels. So arranged, they are adapted to run truly on straight lines of rails. But such straight lines are purely imaginary. Rails are a succession of large and small curves and zigzags, on which the coned rollers incessantly vary their tread, and oscillate from side to side, on sinuous courses, like so many snakes, but not so gracefully. In this oscillating movement the rollers are seeking the path of least friction; and so well is this understood by the engine-drivers that the trains of wagons are coupled only by loose chains or links, for the simple reason that, were they close-coupled together, the friction of the treads and flanges against the rails would be so great that it would be impossible to haul them along. With passenger trains this sinuous motion is so annoying that, perforce, the train is coupled close together to check it, and the wheels or rollers tell the story of the additional friction they thus have to encounter, by the amount of frictional vibration and retardation thence ensuing. And frequently at stations the driver will take the opportunity to loosen the couplings, in order to ease his engine.

LONGITUDINAL SHOCKS.

Longitudinal shocks of more or less intensity, occur in all trains, whether in drawing or propelling, and if the traction and buffing springs be insufficient in elastic power, the frames, especially on curves, are apt to get a diagonal set. In wagons without traction springs or buffing springs, the haulage, by loose couplings, is a succession of violent jerks, frequently breaking the couplings and causing accidents. And again, when the buffers on one side get violent blows on curves, the oblong frame becomes rhomboidal, and though the axles retain their parallelism with each other, they cease to be rectangular to the line of traction, and the wheels remain at a permanent tangent with the rails. In this position the strain upon the axle, by the pressure of the wheel flanges against the rails, becomes enormous, and the longer the wheel base the more mischievous it is.

HAULAGE RESISTANCE.

It may be taken as an axiom that resistance to haulage—apart from gravitation on inclines—is the measure of axle strain in torsion. The normal resistance is assumed to be 8 lbs. per ton of load on the axles, on the level. If, then, we find, as sometimes occurs, that trains of wagons will not run down inclines of 1 in 72 without haulage, we may be sure that there is something vicious in the structure, whether original or induced by violence. Curves and bad permanent way will quadruple the resistance to traction, and practically the resistance in being obliged to shunt a train into a sharp-curved siding will reduce the train by one-third to one-half of what the engine is able to deal with on a straight line.

AXLE TORSION.

Under these circumstances, the railway axle is exposed to great torsional strain, with a condition more trying than that of the fixed axles on the common road. The common road axle being a fixture, if it be weak for its load, any bending is only in one direction, viz., upwards at the ends. If the revolving axle bends under the load, it bends in every direction radial to the centre in a constant succession of changes. The bending, of course takes place in the weakest part, where it is reduced for the bearing, or for the boss of the wheel. If it bends at all under the load, aggravated by eccentricity of movement, the final breakage is only a question of time. The commencement is by a fine circular line round the weak part, so fine as to be undiscernible by the naked eye. This line gradually deepens to a sixteenth of an inch, half an inch, and so on till the central portion becomes too weak to hold it together and it drops apart. Breakage of axles in this mode is not uncommon, and those who have locomotive engines in charge, with cranked axles, maintain that the access of oil in the opening crack acts as a wedge to quicken the fracture, and the question of duration is a known quantity. In truth, the crank axle of an engine is a very weak axle. Its diameter is usually the same as that of straight axles, while its length, if straightened out in the cranks, will be found to be double that of the straight axle.

BREAKING STRAIN.

It will be seen, then, that the cause of the breakage of railway axles is to be found in the fact that they are strained beyond their powers, not by the load, but by imperfect structure of the vehicle they are attached to—imperfect, possibly, originally, but commonly by violence in use. The running is "wringing the neck of the axle."

With a view to lessen lateral friction of the wheel flanges as much as possible, it has been customary to keep the axles as near as possible, together. This, if the bodies be long, involves "hogging," and oscillation, with a bad distribution of the load. Other things being equal, the nearer the axles are to the wagon end, the steadier they will be; but then flange friction increases with the length of wheel base, and a remedy must be provided for this.

Supposing that a train of wagons were built perfectly true at the outset, for a straight line, the multitude of longitudinal shocks would soon set the wheels out of truth, and so the question arises, whether it be possible so to construct them that diagonal shocks to the frame, giving a permanent set, shall not affect the true running of the wheels; and next, whether wagons may not be so constructed as to dispense with the loose coupling, which is a material source of breakage to couplings, and displacement of the wagon frames. We think it is. Desirable as it is to point out the causes of the defects, it is still more useful to point out the remedy.

EXISTING STRUCTURE OF VEHICLES.

The existing mode of construction is, to fix to the sides or sole bars of the wagon four iron forks called horn-plates, up and down which the axle boxes slide vertically with the movement of the bearing springs, similar to the row-locks of a boat which hold the oars. The fit of these horn-plates in the grooves of the boxes

must, of course, be a loose one, or they could not work equally. Consequently, every blow which disturbs the frame carries the horn-plates with it, and sets the wheels and axles askew.

IMPROVED STRUCTURE.

The horn-plates are dispensed with, and, instead of them, axle-guards are made to clip the two axle-boxes firmly, and bend round the wheels horizontally, and form a central pivot-hole 7 in. within each axle. A strong pivot is forged on a plate turning up at the ends, and bolted between the two diagonal timbers of the wagon frame at each end. The axle-guard frame thus forms a caster-pivot, which carries no load, but merely acts as a guide or eccentric center for the wheels. The bearing-springs are fixed on the axle-boxes above the axle-guards, and carrying the load by long pendant round rods, with ball-and-socket heads and nuts passing through strong iron brackets fixed to the sole bars. Thus there is perfect free movement for the axles to move laterally and radially on irregular rails, or when the wheel-flanges press against the outer rails on a curve —when the axles take a true radial position pointing to the center of the curve, each independently of the other. If any distortion happens to the frame by a blow, making it rhomboidal, it does not affect the relative position of the two pivots, and the wheels will run as true with a distorted rhomboidal frame as with a true oblong; and on a straight line the gravitation of the spring shackles insures a rectangular position.

And this free movement of the wheels from side to side, while preventing all jamming of the flanges, will permit the close coupling of the trains without affecting the wheel action, and thus reduce the longitudinal shocks to the minimum. Thus the wagon bodies may form a series of tangents on a curve, free from oscillation. The buffers are curvilinear to give free action. It will be seen that the short distance between the axle center and the axle-guard center, while keeping the wheels true on curves, also keeps the wheels true to the gauge, and free from oscillation. The wagon is adapted to carry 10 tons of coal or minerals quite steadily at any speed. The spring-plates are 6 in. broad, and thoroughly elastic. The cubic contents are 381 ft., and sliding iron bars are made to clip the upper edges, permitting loading without trouble, and holding the light top sides together.

COAL WAGONS DIRECT FROM THE PIT'S MOUTH TO THE CONSUMERS' PREMISES WITHOUT CHANGE.

On this system, the cones of the wheels or rollers may be brought into effectual play, widening the gauge of the rails where the curves are very sharp, thus enabling coal wagons of 12 ft. wheel base and 20 ft. length to go direct to the pit's mouth round curves of one chain radius. Such wagons also will permit the delivery of coal direct from the pit's mouth on to the consumers' premises, such as large gas-works, running on the wheel flanges, on channel rails laid on the streets and roads as tramways, as shown on the diagram. It is true that very sharp curves would involve tread friction, as may be any day seen in street-tramway working, but this can be very easily provided for, and then the movement becomes perfect, and the friction on the channel rails would be less than that on the railway proper, as the flanges would cease to rub.

It is thus possible to get rid of the contingency of railway axles breaking by unfair wear, when otherwise faultless. And when we get to the proper process of forming hollow axles, we shall have far less chance of flaws. And if coal and goods wagons be thus constructed, they may run at as great speed, and with more safety, than existing passenger trains. The cost and consumption of fuel is mainly governed by the resistance to haulage.

EVIDENCE ON INQUEST.

The intelligent evidence given by Mr. Sacre and Captain Tyler made the matter very clear: "The wagon was estimated to carry a load of 6 tons, and the dead-weight of the wagon, unloaded, was 2 tons 5 cwt., and it had been in use 18 years." This was a satisfactory and economical proportion, of ample weight for strength, without the surplus dead-weight we have heard so much of lately. Capt. Tyler said, "the flaw was round the whole circumference of the axle-tree. The flaw was not due to the quality of the iron, but arose from wear and tear. A large portion of the section of the axle had been defective, and it was only a moderate-sized piece in the middle that held on. As the truck worked, the sound portion got smaller, and at last it got so small that it failed altogether."

This is precisely the process of breakage in all railway axles subjected to a bending strain, either by overloading, or by torsion on sharp curves, or by vicious or damaged structure.

In the running of ordinary trains, the tendency is for the leading wheels to hug the outer rail with their flanges where the lines are curved, and the result of this is to throw the trailing-wheels against the inner rail, placing the vehicle in a partly diagonal position, with an incessant sledging, fractional grind, including the "wear and tear," to which Captain Tyler alludes. If the wheels were free, instead of being held fast laterally to the frame, they would find out for themselves the path of least friction; the torsion of the axles would cease, and oscillation of the bodies would disappear also. And be it remembered that the tendency to hug the rail with the wheel flange with rigid pressure is the main cause of "getting off the line."

Mr. Patrick Sterling, the Engineer of the Great Northern Railway, and than whom no more competent engineer exists, said: "It is quite possible that the flaw "in the broken axle might have been an incipient one "at the time of its original construction, but not "perceptible to the eye. A concussion with another "wagon might have completed the break of the axle in "question. There is a considerable curve in the local-"ity of the accident. A curve always brings a greater "strain on the axle than a straight line."

CRANKED AXLES.

In February, 1869, a paper was read on the Mauritius Railway, at the Institutions of Civil Engineers, and, in the course of the discussion on locomotive engines, Mr. Harrison, the Engineer of the North Eastern Company made the following remarks:

"Mr. Adam had stated that he could make an engine which would pass round curves of three chains radius. He knew that gentleman's radial motion had been successfully applied to engines and carriages, and he had no doubt that Mr. Adams was going in the right direction in designing stock for traversing sharp curves, but still he thought it would be much better, if possible, to avoid sharp curves, and thus remove the necessity for adopting these means of working. It was only when the curves were exceedingly sharp that it was necessary to resort to these expedients. There was no stronger argument against very sharp curves than the comparative wear of crank axles on curves and on straight lines, and he could state from experience that a crank axle in an engine working on straight lines would last at least six times longer than the crank axle working over exceedingly sharp curves."

Jeremy Bentham was accustomed to remark that "it would be a great mechanical convenience if the surface of the world were all down-hill; but that as it was not so he must put up with it." And even so we must deal with our railways. Let us by all means get straight lines when we can; and it would be better, on the whole, to make straight lines in given lengths, connected by sharp curves at intervals, than to form them in general curves; only, in such case, we must take care that our moving stock be adapted to work the curves; and, in any case, our wheels and axles should be so constructed as to have free rolling movement under all circumstances, and never be subjected to other strains than that of the direct load borne upon them. With regard to crank axles, there is no apparent reason why they should exist at all, other than a superstition. Straightened out in the cranks, they measure twice the length between the wheels that straight axles do, and yet, strange to say, they have no increase in diameter. The steadiest, fastest, and most powerful locomotive engine now existing on any English line has been produced by Mr. Stirling, and it has a straight driving axle and outside cylinders. It could scarcely exist at all for any useful purpose with a crank axle; and, with requisite appliances, it could, no doubt, work with coupled drivers and increased power.

SUMMARY.

The faults and accidents are not in individuals but in the system of all large establishments, whether government or other, that sticks to red tape and eschews progress, that would build every locomotive and wagon to an antique pattern, in order to save trouble in organization, as though the works of man were as perfect in their beginning as the works of the Creator; as though there were not construction, destruction, and reconstruction in nature itself. But for the competition of individuals, we should still be traveling in stage-coaches drawn by horses, till the world were denuded of its forests. Not for this were our iron and coal stored in the underground cellars of nature!

Safety Signals.

The following is a report on safety signals made by a railroad convention held in the St. Nicholas Hotel, New York, October 17, 1866. It is signed only by Ashbel Welch, General President and Chief Engineer of the United Companies of New Jersey, who was Chairman of the Committee, and, we believe, prepared the report.

Although the convention at which the report was made was held more than four years ago, the report, we believe, was first printed only a few months ago. At least we have not met with it before, and the copy we have is dated 1870 by the printer. However this may be, the document is well worth reproducing, re-reading, and preservation:

The Committee on Safety Signals and Regulations present some general principles which they deem important, and which can be applied according to the circumstances of each road.

Where there is great liability to a break in the track or such obstruction upon it as would cause serious disaster if undiscovered, such as at a drawbridge, tunnel or crossing at grade of another railroad, the thing should be presumed to be wrong until the engineer has affirmative evidence that it is right, that is to say: in such cases SAFETY SIGNALS SHOULD BE USED AND NEVER DANGER SIGNALS. If a danger signal is to be relied on, and if from defect of apparatus or negligence of the signal man or of the engineer, or if from fog, smoke, or any other cause, the danger signal is not made or not seen, the result may be a terrible accident; but when a safety signal is relied upon, then if not made nor not seen, the worst that can happen is a momentary stoppage of the train. In such cases a danger signal should not be used in connection with the safety signals, because engineers become accustomed after a while to look for it, and then if it should not be seen they might presume all right, and disaster might ensue.

The correctness of the foregoing principle was strikingly shown by the terrible catastrophe at Norwalk drawbridge, several years ago. If the train had been required to stop when there was no signal shown that the bridge was right, no harm would have been done; but the engineer, depending upon a signal that the bridge was wrong which he did not see, ran into the river.

In a recent case in England, three freight trains formed a single heap of burning ruins in the middle of a tunnel. The notice that the first train that entered had broken down, was not sent or not received, and the second train ran into the first, and the third into the ruins of both. If the principle above laid down had been in use, and the engineer, instead of looking for evidence that the tunnel was obstructed, had not gone on till he had evidence that the tunnel was clear, no accident would have happened. Neither would the adoption of the safety signal plan in that case have been attended with any increased expense or delay.

We call special attention to this point, because on a great many roads a contrary principle is acted upon, and because so many good railroad men never thought of the difference, and because serious accidents are so frequently happening which would be prevented by the plan we recommend.

Of course there are many things which the engineer must presume to be right, until he hears or sees them to be wrong, such as the general continuity of the track, the safety of the permanent bridges, etc. Other things, such as drawbridges, etc., are so liable to be wrong, and the disaster, if they are wrong, so serious, that they should always be presumed to be wrong till they are proved to be right. What things should be presumed to be right and what wrong, will depend upon the degree of risk and the circumstances of the different roads.

On important double track lines of railroad we recommend that telegraphic signal stations should be established at intervals somewhat less than the shortest that are permitted between trains going in the same direction, and each train on passing such station should be informed by signal that the preceding train going in that direction has passed the next signal station, or in the absence of such information, stop for explanation or proceed under proper regulations, expecting to overtake a disabled train. The display of a danger signal for a given number of minutes after the passage of a train, is not sufficient, for the attendant may neglect to make it, the engineer may fail to observe it, or if made and observed, and the proper time has elapsed, the preceding train may be broken down, and in the confusion attending upon an accident, no warning may be sent back, or if sent back may not be seen. These are not mere possibilities but things of frequent occurrence. Notwithstanding the use of torpedoes and other danger signals sent back from disabled trains, we often hear of accidents by failure to observe them.

Probably not one cause of disaster is so frequent on the main lines of railroad as one train running into the rear of another. It seems to us the plan proposed ought to prevent such accidents, or at least to render them very infrequent.

Such a plan has been in use for a year past between Philadelphia and New Brunswick on the main passenger route between Philadelphia and New York, and experience confirms our confidence in its value. The signal used in this case is a white board, and white light at night, shown through an orfice two feet in diameter in a black signal box, so placed that it can be seen as far as possible. A partition in the box separates the signals for the opposite direction. The signals are exhibited to the approaching train by the attendant at the telegraphic instrument pulling a cord, and then the moment the engine passes letting it go, when the signal drops into the lower part of the box out of sight. One important precaution is that the signal should never under any circumstances be fastened up, as there would then be a possibility of its being neglected and showing a clear track when it should not.

It is necessary to have a separate telegraph wire for this purpose not liable to be used for anything else.

As a train passes, a *counter* is used to represent it. This is removed when the train is reported past the next station. Nothing is left to the memory or judgment of the operator.

Drawbridge and switch signals should not be in the hands of men, but connected with the strctures themselves, so that they cannot show right when the thing is wrong, and they should be so contrived that if out of order they will be out of sight; their absence will then require the train to stop and examine.

For twelve or fifteen years past there have been used on the Belvidere & Delaware Railroad drawbridge signals which can only be exhibited by the insertion of the bolt which fastens down the latch of the bridge, and thus insures the continuity of the track.

There have also been used on the same road during the same period, for switch signals, large parallelogram surfaces uniform for the whole road, on each of which is painted a long white cross on a red ground, directly connected with the main switch and by a long wooden rod with a movable short switch, used instead of a frog. No engineer can mistake the position of the signal and therefore of the switch, at a mile distance. Many who have observed those signals for years consider them in some situations safer without an attendant, than an attendant and his flag without the self-acting signal.

An excellent revolving switch signal is in use on the Erie Railway and probably on many other roads, in which a white pointer, or by night a white light, indi cates that all is right for the main track. Perhaps they would be better without the red pointer, which shows that the switch is wrong, and which the engineers may get into the habit of looking for, and when from any cause they fail to see it, may erroneously presume the switch is right. They should regard only the safety signal.

The following plan of signal to prevent collisions on railroads crossings each other at grade has, after much consideration, been adopted at the intersection of the Philadelphia & Trenton and the Reading railroads. On the former, trains are passing very frequently. On the latter, trains of cars are passing every few minutes. A hollow cylinder elevated so as to be seen by all concerned, has four openings, one each way for each road. Through these a revolving cylinder is seen, with a light in it by night, on which two opposite spots are white, all the rest red. When white is seen through openings towards one road, allowing its trains to proceed, red will be shown through the other, and while it is being shifted, or when no train is approaching, red will be seen through all. No train is to proceed till the white is shown.

Signals should be at known and conspicuous points where they will be always looked for, and, therefore,

most likely to be observed; for example, if the track is disturbed, notice should be shown at a telegraph station or other point where it will be looked for, as well as near the spot.

Signalmen should be so circumstanced as to be kept cool and alert, not distracted by too many engagements, and comfortably sheltered. A brakeman sent back with a red light with the thermometer ten degrees below zero is a very unsafe guard against danger.

When discretion must be used by any one, it should be by the engineer rather than by the signalman, as the former is supposed to be a superior man and has more at stake.

Signals should be simple and not repeated. An engineer going forty miles an hour can attend to and understand one signal when he might be confused by two.

Colors should be used which can be seen the farthest, that is red and white, and these, combined in such well-known forms that they cannot be mistaken for any other object of the same colors seen in the same direction.

Flags are less safe than globes or flat surfaces, for they are liable to be blown edgeways to the observer.

Signals and safety regulations should be uniform for each road, and as far as possible for all roads, especially for those connected with each other. The apparatus and mode of working should be minutely prescribed, and carried out with precision. As little as possible should be left to discretion. Emergencies should be provided for by rules deliberately made.

The clocks at all railroad stations should be set daily, or at least frequently, by telegraph from the standard clock. They should not be unnecessarily multiplied for fear that some may be left wrong, and so mislead. It is a good plan for watches carried by each conductor and engineer to belong to the company, and be delivered to a time clerk on arrival at each end of the route, to be set right by him and received from him at departure, and compared with the clock both by him and the person carrying it. Allowance of a minute or two or more should be made for error in time before a train should run on the time of another which has lost its right. As far as practicable, connected roads should use the same time.

All which suggestions are respectfully submitted.

Fastening Steel Tires.

Mr. William Toothe, agent of the William Butcher Steel Works, has written some comments on the report of the Committee on Steel Tires of the Master Mechanics' Association, which is published in the *American Railway Times*. In the course of this letter he speaks as follows of the modes of fastening steel ties, and their effect upon wear:

As to the life of steel tire, as far as I can gather from records of service, it may be averaged at two hundred thousand miles, that is, for a two and a half inch tire on, say, a thirty ton engine. But, as is intimated by Mr. Hayes, Mr. Setchell, Mr. Holloway, and others, a two and a half inch tire is not thick enough; and when we take into consideration the enormous waste of material caused by using a three-quarter inch set screw, a three-inch tire for any service is sufficiently thin. I except, of course, a six-foot wheel under a light engine, when a tire fastened with set screws may be safely used at two and three-quarters of an inch thick. Think what is taken out of the body of a two and a-half inch tire by using screws of such a size!

I do not wish to set my judgment in opposition to those gentlemen who believe in set screws. There may be circumstances to make it seem reasonable with some mechanics to use them; but in fully one-half of the cases of tire breakage, I believe they may be safely attributed to the operation of set screws. Over-shrinkage may have had something to do with it and bad boring, or no boring at all; but set screws penetrating a tire three-quarters of an inch make such an infraction upon structure of steel that fifty per cent. of the breakages may be justly charged to them. They might be driven through the face of an iron tire and work down with it, but when a steel tire is worn down to the end of half its life, they will cause breakages faster than anything else. If they are set in to provide against a steel tire drawing when worn down thin they are perfectly useless; for when worn thin a steel tire *will* draw, though not so much as iron. Whatever may occasion their use they are always dangerous to steel; and in any event, it is simply to endanger a tire from the first moment it is put on the road, to perforate it over a quarter of an inch. A steel tire well bored, and set on a perfect circle, which a wheel ought always to have, and then properly shrunk, furnishes a better provision against all sorts of accidents and contingencies and will ensure a better mileage and longer life than any device of set screws or additional fastening whatever. A three-inch steel tire, correctly bored, and correctly shrunk on to a perfect periphery, I believe will average three hundred thousand miles in any service. Mr. Burke might well say, by way of parenthesis, in view of some of the averages, that iron tire might begin to look up again.

Special localities and special service may have much to do with excessive wear in steel tire; but I do not refer to those cases, they are exceptional and should be so considered in the report. A general average of steel tires will show a better mileage when the important points of boring and shrinkage are better understood and when set screws become obsolete. In my experience, only one steel tire has actually worn out. (I speak of the United States.) It was put on by shrinking alone. When worn down to an inch and one-eighth thick it looked a little loose, and was taken off and reset. It was found to have drawn a trifle. When taken off it had run about two hundred and twenty thousand miles. It afterwards run about twenty thousand more, (I state only from memory), when it was worn out. It was originally two and one quarter inches thick. The engine weighed 32½ tons and had two driving wheels, and ran altogether in passenger service.

Papers on Iron and Steel.

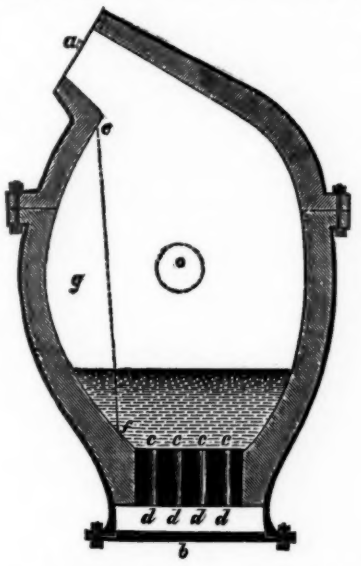
BY W. MATTIEU WILLIAMS.

NO. II.—THE BESSEMER PROCESS.

In this paper I propose to describe the general phenomena of the Bessemer process, and then to examine the chemical actions producing these phenomena and the changes they effect in the material operated upon.

In the first place the pig-iron is melted in a suitable furnace, usually in that form of furnace known as the "cupola." The melted iron is run from this by means of moveable troughs into the "converter," which is a pear-shaped spouted vessel, lined with fire-clay, "ganister," or other refractory substance.

This pear-shaped vessel, a vertical section of which in the upright position and without mechanical details is represented in the annexed figure, is truncated at the lower end, and thus a flat circular bottom is formed. This bottom, which is readily detached and renewable, is fitted with longitudinally perforated fire-clay cylinders shown in section at *cd*, *cd*, *cd*, *cd*, each perforation or clay tube being about one-half or three-quarters of



an inch in diameter, and all communicating with the space *d d*, into which opens the blast tube from a powerful blowing engine. The number of these blast holes varies from fifty or sixty to a hundred or more, according to the size of the converter.

The converter is mounted on trunnions so arranged that it may turn on a transverse axis crossing about the middle of the vessel, as shown by the dotted circle *o*. The turning is effected by hydraulic machinery, controlled by levers readily worked by a man who stands on a platform in full view of the converter (the lining of which has been previously raised to a bright red heat) is turned over so that the dotted line *e f* becomes horizontal and corresponds to the surface of a full charge. The belly *g* of the converter is so curved that it shall in this position retain the whole charge without any of it reaching the blast holes at *f*, or the mouth at *e*, and yet allow the whole charge to be readily "teemed" by turning the converter a little further down.

When the full charge is thus received in the belly of the converter, the blast is turned on, *after which* the converter is turned to the upright position, as shown in the figure, and the melted metal then stands directly over the perforated bottom, As will thus be seen, all the fluid metal above the openings is now resting upon a bed of air, and is only prevented from falling through by the blast being maintained at a pressure exceeding the falling force of the column of liquid above it. It would fall through these orifices into the blast-way and do serious mischief should the blast be stopped or slackened for an instant, or should the converter be turned upright or overcharged before the commencement of the blast. An accident of this kind but rarely happens, though it is by no means an unknown casualty.

The "blow," as it is termed, now commences; the hundred streams of air tear through the pool of melted iron, and a huge flame roars furiously from the mouth of the converter. At irregular intervals magnificent cascades of brilliant coruscating sparks are belched forth, and the dazzling spray as it dashes against the walls of the flame-shaft rebounds with redoubled splendor, each glowing globule being shattered by the shock and bursting into rescintillating fragments. The loud-bellowing blast roars on monotonously, but the flame becomes brighter and brighter continuously, and grows in length and breadth as it increases in brilliancy, until at the end of about ten minutes it attains its maximum, when its splendor is painful to the eye, and yet so fascinating that few who see it for the first time can turn their dazzled eyes away. The spark eruptions still burst upwards from time to time, and still dash against the brickwork and the ground, and still reverberate in fiery splinters, but their appearance has changed. They are now no longer red hot, or yellow hot, or white hot, but have a curious purple luminosity different from anything one has ever seen before. If it is daytime and the sun is shining, the sunlight out of doors has a sickened partial-eclipse aspect when viewed directly after gazing at the flame, and at night the ordinary gas lights appear red and smoky.

After five or ten minutes' continuance of this maximum splendor, the flame is seen to contract somewhat, and presently the wonderous vessel turns a very deliberate sommersault, the flame disappears, but the uninitiated spectator is startled by a new display; for as the converter rolls smoothly over, it disgorges a continuous stream of sparks which its rotation spreads out in a fan-shaped volley, extending from end to end of the building, and reaching the roof, descends in a broad sheet of fiery hail. This is the transformation scene which concludes the first part of the performance; for now the dazzle of the flame and the roar of the blast ceases, and a general lull intervenes.

The trough from the cupola is now swung round to the mouth of the converter, a red glow is seen to creep along it, and starry sparks dance above as it advances. This is the spiegeleisen coming from its cupola by the same path as conducted the main charge. The spectator should now change his position, and if possible find a standing place from which he may look into the mouth of the converter. At first he will distinguish nothing but a yellow glare, but by steadily fixing his gaze, he will presently, and rather suddenly, distinguish the surface and limits of the pool of melted metal. He will see that as the spiegeleisen pours into it, a furious ebullition takes place. At the same time a great mass of pale blue flame issues from the mouth of the converter, but with a quiet, leisurely waving that contrasts curiously with the previous roaring jet of white flame. This flame has but very little intrinsic luminosity, yet at night it lights up all the surrounding objects with a singular brilliancy, a sort of exaggerated theatrical moonlight effect, which is the most remarkable to a spectator outside, who on a misty night sees the long streams of ghostly light pouring through every opening of the building in pallid beams, that under favorable conditions may be traced for above a quarter of a mile. I have seen them projected in bright discs upon the face of low clouds, and visible through the whole of their intermediate course.

When the flow of spiegleisen has ceased, the trough is moved aside and a large counterpoised arm bearing the "ladle" is swung round upon an hydraulic piston, which forms at the same time its axis and lifter. The ladle, a large lined iron pot, is adjusted under the mouth of the converter, which is now tilted a little more, till the melted metal is poured out in a thick brilliant white-hot stream accompanied from time to time with great slabs of cinder of a dark color which floats upon its surface as it pours, and form a thick scum covering the contents of the ladle. When all the fluid metal is poured into the ladle, the converter is tilted over until completely inverted, and the remaining vicous mass of cinder drops out in a glowing heap upon the floor.

During these proceedings a set of workmen have been preparing the molds in which the ingots of steel are to be cast. These molds are of cast-iron, nearly cylindrical, being larger at bottom than top, and open at both ends. They have lugs or handles at top by which they are lifted. They stand upon a tile, and are well packed round the bottom with sand to prevent the outflow of the melted steel. While the blow was proceeding these were arranged in an arc of a circle whose radius exactly corresponds with the length of the arm bearing the ladle.

The ladle is now swung round and adjusted till it stands directly over the first of this row of iron vases, and a plug is released by which a hole in the bottom of the ladle is opened. Through this the steel is poured into the ingot. When the first is filled the plug is closed, the ladle swung round to the second mold, and so on, till all the steel is thus cast into ingots, the size of which varies with the kind of work for which the steel is required. A thin steel plate is placed on the top of each casting immediately the mold is filled, and over this a bed of sand is placed, and speedily and firmly pressed down.

As soon as the ingots have solidified, and while they are still glowing, the molds are lifted off them by means of an hydraulic crane, and afterwards the ingots are picked up by tongs attached to the same machinery, and are carted away, all red hot, to the hammer shops, where they are thumped and rolled or otherwise tortured into their required forms of rails, tires, plates, etc.

The above are the leading phenomena of the Bessemer process; the chemical actions producing them, and the changes wrought in the pig-iron and spiegeleisen, will be treated in another part of this paper.—*Nature.*

St. Joseph Temporary Bridge.

A correspondent writes us that this bridge, which is a private enterprise, was completed on the 25th ult., and freights are now received and delivered over it by the St. Joseph & Denver Company. The river is at present very low, the channel where the bridge crosses being about 250 feet wide. The approaches on either side are built on piles, while the main span is a *hull* which can be cut loose when the ice breaks and be swung into position when it freezes again. The profit to the projectors will of course depend greatly on the weather.

—Mr. Vogel, Postmaster-General of New Zealand, has made a contract with the Webb line of steamers for mail service between San Francisco and New Zealand, and if Congress grants the subsidy asked, it is said that regular trips will be made between San Francisco and Australia, touching at Honolulu and New Zealand.

—A bill has been introduced into the Missouri Legislature to establish three cents per mile as passenger fare on all railroads in the State. A freight tariff per mile is also proposed.

Inside the Patent Office.

The following interesting sketch is given in a letter to the New York *Evening Post* by Elizabeth Kilham:

Included in the Department of the Interior are the General Land Office, Pension Office, Patent Office, Indian Bureau, Census Office, and Bureau of Education. The building known as the Patent Office, next to the Capitol the finest of the public buildings of which Washington is so justly proud, was originally intended only for the business of that office, although nearly all the business of the Department of the Interior has been transacted there. The original intention, must, however, soon be carried out, for the rapidly-extending business of the Patent Office will necessitate the appropriation of every foot of room in the building. Already the Bureau of Education, the Census Office and part of the Pension Office have been crowded out, and occupy offices rented for their use by the Department, and the others must soon follow. Then we shall have the grand spectacle of the whole of this magnificent building consecrated as the repository of national genius.

ITS EARLY HISTORY.

The Patent Office was established by the first Congress in 1790. Their act was superseded by the one of 1793, and this again by the act of 1836. This last, entitled "An act to promote the progress of the useful arts," forms the basis of our present system of patents. The American system differs materially from that of Europe; the distinctive feature of the former being the preliminary official examination to determine as to the novelty and utility of inventions before granting patents. In Europe, registration is all that is necessary to obtain a patent.

ABOUT INVENTIONS.

Inventions are divided into thirty-six classes. The classification sometimes strikes one as rather curious. Thus, under the head of "fine arts," we find engraver's tools, postage stamps, theatrical scenery and tombstones. Probably it never occurred to many of us that the designs for our postage stamps are particularly artistic; and we can all recall tombstones, which, if the word art may be used at all in their connection, are, we should hope, only specimens of some of the "lost arts." Toys and games also come under this head. The room for the examiner for this class is in itself a little museum of art. Most interesting among its curiosities are a photograph copy of the English Doomsday Book, and some exquisite specimens of the new German discovery of "nature-printing."

Since the organization of the Patent Office one hundred and ten thousand patents have been granted. Between five and six hundred of these were to citizens of foreign countries; the remainder to American citizens. The acting Commissioner, General Duncan, in an exceedingly able and interesting lecture delivered before the American Social Science Association last March, makes the following distribution of patents: "To "New England, about twenty per cent., Massachu- "setts having as her share ten per cent. and Connecti- "cut five; to the Middle States, thirty-six per cent, "New York alone receiving twenty-three per cent.; "to Ohio and Illinois seven per cent.; to California, "two per cent.; and to the eleven states that engaged "in the rebellion, but four and one-half per cent." In evidence of the impulse given to the Southern mind by the removal of the institutions which produced such complete mental and physical stagnation, may be taken the fact that while before the war the agricultural inventions of the South were barely two per cent. of the whole, they have, since the close of the war, reached seven per cent.

Inventions are most numerous in agricultural implements and household conveniences. Of agricultural inventions, the greatest number is from the West; of inventions in manufactures, from New England and New York. The applications for patents form a curious index to the mind of the country. There are what may be called epidemics of invention. Whatever interest is dominant for the time being is almost unerringly indicated by the business of the patent office. It is like laying the finger on the pulse of the nation and counting its heart-beats. During the rebellion, inventions and improvements in everything that could in any way be used in war, completely overwhelmed the examiners. During the velocipede mania, four hundred and thirty-two applications were made for patents in four months' time. Never a great fire but brings out some improvement in fire-escapes or heating apparatus. Never a great burglary but is almost immediately followed by one or more inventions in locks. Scarcely a kerosene accident but brings an improved burner. In this one article, over four hundred patents have already been granted. Last spring, when so many banks were deceived by checks altered from small to large amounts, there were filed, in less than a week, over forty applications for patents for an invention by which such alteration could be at once detected. Each one of the forty applicants expected, no doubt, to make his fortune from so exceedingly useful and important an invention. They all embodied nearly the same idea, and an examination showed that a patent had been issued for the very same thing thirty years ago. When Planchette was the rage, a dozen inventions of that kind were before the Examiner at one time. To all of them patents were refused, on the ground that it was not a useful invention; but, on the contrary, decidedly pernicious and mischievous, many persons having thereby been rendered insane.

HOW TO GET A PATENT.

Before granting a patent various questions besides the novelty of the invention are considered. This is, of course, the primary question, "Is it new with the applicant?" The decision of this question involves an immense amount of labor and research; an examination of all the reports and drawings, not only of American patents, but those of foreign countries and numerous scientific works. Legal questions are also involved which must be carefully decided. The question of novelty being settled, that of utility arises. Is the invention useful; or is it trivial, inoperative, or positively injurious and hurtful? In either case a patent is refused. A notable case of refusal of a patent on account of the mischievous tendency of the invention occurred under the administration of Hon. Joseph Holt. The applicant desired a patent for "a policeman's club so "constructed that upon releasing a spring a triple row "of keen-edged lancets would leap from hidden recesses "and mangle the hand of an adversary." The applicant's professed object was to provide a weapon which should obviate the necessity of the carrying of firearms by policemen, and yet to furnish them with as full means of protection. The Commissioner refused the patent on the ground that while the professed object was a laudable one, "the transforming of the imple- "ment to a weapon of offense in the hands of despera- "does, as would inevitably be done, would be a great "evil." In his decision occurs this forcible sentence: "An invention, to be patentable, must not be useful to "the few with a chance of its becoming hurtful to the "many; but it must clearly appear that in view of the "interests of the whole community, the good would "decidedly preponderate over the evil."

In almost all classes of invention the names of women appear as patentees. In articles of wearing apparel they are largely represented. Several improvements in cooking stoves bear female names. An Indiana lady has invented a fluting machine; another, within a few months, has taken out several patents for different improvements in the construction of axles; and women's names are attached to some valuuble improvements in surgical apparatus, this last forming a strong argument in favor of the idea advanced by some eminent physicians that women are peculiarly fitted by nature for the study and practice of medicine.

THE HALL OF MODELS.

There is no pleasanter or quieter lounging place in Washington than the "hall of models" in the Patent Office. Here, in the recess of one of the windows looking upon the pretty inner court of the quadrangle, one may read or think for hours undisturbed. Occasional visitors are no interruption, for they are lost in those seemingly endless halls, and that forest of cases. Watching and listening to some of them, one wonders why they come there. A lady, pretty and stylish, stands for a moment before the complex and wonderful machinery of a town clock, embracing in itself three distinct clocks, all working in perfect harmony, over which a man of genius spent the best years of his life, and turns away with the appreciative remark, "Aint it funny!" A party, from the country evidently, not quite clear as to the object of their visit, stand in wondering silence, till one adventurous spirit breaks the spell, "Mercy! what a sight of work it must be to keep all them windows clean." Two or three young men stroll along, swinging their canes and staring vacantly round, till one says, "Come, let's go; there's no fun here;" and they turn their backs upon one of the wonders of the place, an exquisitely delicate apparatus, patented by a Frenchman, for the measurement of electric currents. Then there are men with keen, eager, anxious faces, studying models, some of them on their knees before the cases, their whole soul in their eyes, as they try to determine whether the idea they look upon as their own is really so, or has been anticipated by another, and the determining is to many of them almost a life or death matter.

A PLACE OF ARBITRATION.

Leaving the "model hall," we descend to the lower floor, and passing the examiners' rooms, the library, with its twenty thousand volumes; the draughtsmen's room, where are preserved drawings of every invention for which a patent has been sought since the organization of the office; the record room, where are the printed reports of patents granted, the issue of each week in a separate volume, we come to the sunny southeast corner, where in a pleasant room, brightened by that most cheerful of inanimate things, a blazing wood fire, the Commissioner "improves each shining hour." We will go in here.

The stream of business is at flood tide, and we sit quietly and watch and listen. One o'clock is set for the hearing of a case of "interference." An interference is a proceeding to determine which of two or more persons has the right to an invention, each claiming to be the first inventor. The principals are not present. Their respective attorneys argue the case—outwardly calm, inwardly raging. "Their words were smoother than butter, but war was in their hearts." The decision is made, and they retire; one jubilant, the other in an unmistakable fit of the sulks. "Will the General see a "gentleman?" inquires the magnificence at the door. The General will; and a quiet-looking, elderly man enters, evidently under great excitement; that kind of excitement so intense that it produces a calm almost like death. He lays a model on the table. "This does "not represent my case," he says. "I find that the model "is made wrong. This," holding out a little piece of machinery, "should have been put in instead of that. Can "I substitute it now?" "How is your drawing?" the Commissioner asks "does it correspond with this "model, or with what you intended?" "It is like this." "Then all you can do is to withdraw this and file a new "application." "I have spent months upon this;" his hand trembles and there is a quiver in his voice.

The General's keen eye takes it all in, and very gently he says: "I wish I could do otherwise; but in "these matters the office has no jurisdiction; we have "to go according to law." He takes up the model upon which "some one had blundered," so sadly for him, and goes out with the "bitterness of death" in his face. It is hard to think of those months of labor, and the fee for a new application may not be easy to get. Ah! well; he is but one. Another has come all the way from the Pacific coast, only to find that his agents have not fulfilled their trust, and that nothing has been done where he supposed that everything was done. And others come and go, and tragedies and comedies are acted out in bewilderingly quick succession. And, remembering all the years that this has been, we think, if these marble walls might speak, what they could tell of numbers who have passed up the stately steps and between the Doric columns with elastic and high hopes, and by and by crept out with the gray shadow of disappointment on their faces, and in their hearts the bitterness of a broken hope and a disappointed life.

First Passage Through the Mont Cenis Tunnel.

A correspondent of an Italian newspaper gives the following account of the opening of a practicable passage through the Mont Cenis Tunnel:

The band, composed of laborers, struck up the "Royal March," and the country folk flocked round the mouth of the tunnel as we made our triumphal entry in four railway carriages. We were about a hundred in all. Knowing that the temperature would be very different in the bowels of the earth, we had doffed our winter garments, exchanging them for lighter materials, a precaution of which we had no cause to repent, for before we had made a kilometer the centigrade thermometer marked 17 deg. above zero, and then successively 20, 23 and 29.50 deg., (63 deg., 68 deg., 73 deg., and 85 deg. F.). During the work the temperature rises to 35 deg. (95 deg. F.) At the end of the sixth kilometer, the rails not being laid beyond this point, we had to alight and proceed on foot. The dense darkness was lighted up by the torches and lanterns borne by the workmen. At last we stood before the curtain of rock still stretched between the two portions. In this mass a hole had been pierced, allowing the parties on the opppsite side to shake hands. You may well imagine with what feelings we contemplated the work accomplished, thinking of the untiring activity, the intelligence and the dogged endurance with which the gigantic enterprise had been carried through. The mines were prepared, and nothing remained but to charge them and apply the match. Perspiring at every pore, we had to retrace our steps about half a kilometer, in order to allow this last operation to be performed. The pen of a Dante alone could describe this Vulcan's forge, and its half-naked bronzed figures flitting to and fro in every direction, torch in hand. Close upon five o'clock a terrible detonation was heard—the first mine had exploded. So violent was the shock that all our lights were at once extinguished, and we remained in utter darkness. Then crash upon crash in quick succcession, volumes of smoke, a fearful stench of gunpowder and the breach was opened. We sped forward. What a solemn moment was that! We jostled one another unmercifully in our hurry to pass through, for everyone was eager to be foremost. The first over was the engineer Grattoni, who had to duck his head to avoid many a knock against the shattered masses of rock. And then the double current of visitors from Bardonecchia and from Modane met, and cries of "Viva l'Italia—Viva Vittorio Emanuele," resounded sepulchrally through the vaulted passage. The great work was accomplished after 13 years and 40 days of unremitting toil, and as we shook hands all round we recalled to mind how many had tried to throw cold water upon the scheme, declaring it physically impossible, or at best, very doubtful.

—The railroad committee of the Massachusetts Legislature has been considering the free pass question, but without coming to any definite conclusion regarding it. The Boston *Advertiser* says: "Mr. John I. Baker, of Beverley, favored compelling all the railroads in the State to give free passes to members of the Legislature, so that such passes could no longer be considered a favor, and C. F. Choate and Mr. Carter favored a law forbidding railroads to give passes to anybody, even to directors. Mr. Adams, of the railroad commissioners, was called on for information as regards the pass question, but said the commission had not considered the matter sufficiently to be able to make any recommendation, though they hoped to be able to do so next year. All experience shows that it is idle to forbid railroads to issue any free passes, for such a restriction is easily evaded. But the free pass evil is a great and growing one, and if the railroad commissioners can devise any remedy for it, they will merit the thanks alike of the railroads and the public."

—It is said that the result of the negotiations of General Rosecrans with the Government of Mexico is the securing of a charter of a railroad from the Gulf of Mexico to the Pacific on any line the incorporators may choose, save that it must connect with the City of Mexico by a branch if the main line shall not pass through it. About 5,000 acres of land per mile are to be given to the company. The incorporators are Antonio D. Richards, Santiogo Smith and Jose Brennan, all citizens of the United States.

—The new railroad from ocean to ocean through Honduras, from the bay of Fonseca on the Pacific to the town of Frajids, on Hunduras Bay, will make a line from Europe or New York to the Pacific, about 700 miles shorter than that by the Panama Railroad. It It will pass through a productive country, and will probably have a greater local traffic than the Panama Railroad; but its through business will doubtless be less than that of the Panama road is now, even if it should get the lion's share; for it will hardly take anything from the Pacific railroads.

General Railroad News.

OLD AND NEW ROADS.

Barre & Gardner.

The Springfield (Mass.) *Republican* says that of the entire length of the Barre & Gardner Railroad from Worcester to Gardner (23 miles), more than 20 miles is graded, ready for the rails, and the work on the cuts and fills of the remainder is being pushed as rapidly as possible. Track laying will begin as soon as the frost is out of the ground in the spring.

New York & Harlem.

The report from this company to the State Engineer of New York for the year ending September 30, 1870, gives the following statements:

The receipts were as follows:

From passengers	$1,648,887
From freight	1,288,688
Mail service	12.537
Expresses	15,964
Rents receivable	48,468
Haulage of cars	85,788
Miscellaneous	1,000
New Haven Co.—use of road	207,695
Total	$2,709,077

The payments, other than for construction, were as follows:

For transportation expenses	$1,685,472
For interest	363,5 6
For dividends on stock—8 per cent	631,578
United States tax on earnings	26,316
Cash on hand	2,305
Total	$2,709,977

The stock and debts of the company are as follows:

Capital stock	$8,000,000
Funded debt*	5, 72,840

* Real estate mortgage not included in above, $629,000.

Chicago & Iowa.

Regular passenger trains are running from Aurora to the end of the track, which, at last accounts, was within two miles of Oregon. Mr. Blunt, the Chief Engineer, is now making a preliminary survey from Oregon westward, to pass through Mt. Morris, Foreston and Shannon to the Mississippi River.

Pekin, Lincoln & Decatur.

The Pekin *Republican* learns from the officers of the company "that arrangements have been made for the "immediate completion of the entire line of road. "The iron for the whole line has been purchased, over "thirteen hundred tons of which is now on the way to "Pekin from New Orleans. A new locomotive has "also been purchased and will be delivered within two "week, and arrangements for passenger cars and other "rolling stock to complete the outfit of the road are "also in progress."

Lease of Camden & Amboy.

The Philadelphia *Ledger* says that the question of leasing the property of the United Companies of New Jersey has been referred by the President of the Pennsylvania Railroad Company to a committee of the directors consisting of John Rice, Josiah Bacon, Washington Butcher, Wistar Morris, and Lewis Elkin. A committee composed of the directors of the Camden & Amboy Railroad Company has been directed to meet the committee of the Pennsylvania Company.

Peoria, Pekin & Jacksonville.

The Jacksonville *Journal* says that a mortgage was filed for record in Morgan County week before last, made by the Peoria, Pekin & Jacksonville Railroad Company over to Mr. Francis B. Cooley, of Hartford, Conn., to secure the payment of one thousand bonds, amounting to $1,000,000, the bonds bearing 7 per cent interest, and running till the year 1900. The mortgage is stamped with five revenue stamps of $200 each.

Eastern Railroad.

The annual report, presented to the stockholders on the 6th inst., shows that the receipts from the operating department during the past year have been $1,718,-755.16 against $1,607,349.61 for the preceding year, an increase of $111,405.55. The expenses for the same period were $1,018,039.14, an increase of $48,556.27 over the year before.

The work of construction on the Portsmouth, Great Falls & Conway Railroad, is being prosecuted with vigor. The contractors have stipulated that the railroad as far as West Ossipee shall be ready for the rails in June next.

By the terms of the lease of the Portland, Saco & Portsmouth Railroad to the Eastern Railroad, and the Boston & Maine Railroad, of April 1, 1847, either party was authorized to terminate the lease and contract by giving one hundred and eighty days' notice of an intention so to do, and paying to the other $200,000. In July last the Portland, Saco & Portsmouth Railroad Company gave notice of their intention to so terminate the contract on the 20th day of January.

Iowa Midland.

The contract for construction of about 32 miles of this Iowa road, from Maquoketa to Anamosa, has been awarded to Colonel W. T. Shaw, of Anamosa. By the terms of the contract the road bed is to be finished by September 1, of this year.

St. Croix & Superior.

The bill long pending in the lower house of Congress providing for the continuance of the land grant to this company was finally defeated last Thursday. It is thought that this vote indicates that no land grants will be made by this Congress.

Omaha & Northwestern.

Trains commenced running regularly between Omaha and Blair on this railroad last Monday.

Rutland Railroad.

From the company's annual report, submitted at the stockholders' meeting on the 26th ult., we learn that they have leased a section of the Vermont & Massachusetts road for fifty years at the rate of $42,000 per annum for the first five years, $48,000 for the next five, and $54,000 for the last five. They had also leased the Vermont Valley road of E. R. Birchard and John B. Page, who had been operating under a private lease at the rate of $65,000 per annum for four and one-half years and $72,000 per annum thereafter. They had also concluded negotiations for the lease of the Addison Railroad as soon as it shall be completed. They further proposed to purchase the individual stock of the Burlington Steamboat Company. The other leases by the company are of the Montreal & Plattsburgh Railroad, at $42,000 per annum and taxes, and the Whitehall & Plattsburgh Railroad, at $20,000 per annum and taxes. The aggregate annual rentals amount to $169,-000. The operations of the road for the year ending October 31, 1870 show the following results:

Receipts	$,041,509 92
Expenses	755,918 25
Net earnings	$285,641 67

This road, it will be remembered, was lately leased to the Vermont Central Company.

Ohio & Mississippi.

The directors of this company have announced that they will soon change the gauge from 6 feet to 4 ft. 9 in. This change, it will be remembered, was commenced about two years ago, when the Erie Company made some arrangement by which it was abandoned for the time, in order that a broad gauge line from St. Louis to New York might be presented. But it is now rumored that the Baltimore & Ohio Company has entered into close relations with the Ohio & Mississippi, and that the latter company is convinced that it can afford to give up its close connections with the Atlantic & Great Western and the Erie, for the sake of connections with all the other lines. It is very likely to obtain considerable through businesss from cross roads, if this change is made, which otherwise would certainly go to other lines.

Peoria & Rock Island.

Fifteen miles of iron have been laid on this road through Peoria County, and the company has received the $50,000 of Peoria County bonds subscribed. These 8 per cent. bonds running 15 years were sold in Connecticut at 90.

Chicago & Michigan Lake Shore.

This road has lately been opened from St. Joseph northward 34 miles to Garnett, where the Kalamazoo & South Haven road crosses it. The line is to be completed to Nunica so that trains may run through from Whitehall to St. Joseph and Chicago, early in April.

Vermont Central.

The company offers to lay a track from Montpelier to Royalton, by way of Barre, Williamstown, Brookfield, East Randolph and East Bethel, upon the condition that the people along the route form a company, elect officers and subscribe for stock to the amount of $250,000. Nearly $150,000 of this amount is already subscribed.

Maine Railroads in 1870.

A correspondent of the Boston *Advertiser* makes a summary of the condition of the railroads in Maine from the railroad commissioners' report:

The Androscoggin Railroad Company has the past year extended its road across Sandy River to Farmington village, building a fine passenger station and a commodious freight house. It has laid 125 tons of new rails, 28,000 new sleepers, and kept the road in general good order.

Very little work has been done on the Portland, Saco & Portsmouth road, besides the general repairs to keep it up to the standard of a first-class road. New side tracks at several stations have been put in.

The track and rolling stock of the Boston & Maine road have been kept up to their usually high standard.

The Great Falls & Conway road is in a safe condition, and its equipment in good order.

Ground was broken upon the Portland & Ogdensburg road, September 7, 1869. It is now open to West Baldwin, 33 miles; and graded to Fryeburg, 50 miles. It is expected that the road will be open to Fryeburg and Conway the next season.

The Portland & Oxford Central road has been extended to Canton, making it 27½ miles from its starting point on the Grand Trunk at Mechanic Falls. The piece of five miles from Hartford to Canton village, opened the past season, is not yet fully completed, although cars pass over with safety. The track from Mechanic Falls to Hartford is in good condition, although the rolling stock is not quite such as the travel and business require.

The track of the Bangor & Piscataquis road has been greatly improved. The business of the road is gradually increasing. Its construction has stimulated several manufacturing enterprises along the route.

The Portland & Rochester road is open to Springvale, 36 miles by rail from Portland. Four miles have been built the past season. The bridge over the Mousam River is a very fine structure. The road will be open to Rochester early in July. The equipment is in good order.

The Belfast & Moosehead Lake road is in the main well made. Its various bridges and other appointments will rank it among the first-class roads in the State. The road was opened in November. The gauge of the road has been narrowed and rolling stock put upon it by the Maine Central.

The improvements commenced last year upon the Atlantic & St. Lawrence road have been carried forward successfully. Eighteen hundred tons of rail and 45,000 new ties have been put in track, and 16,637 rods of new board fence, with cedar posts, rebuilt. Several new bridges have been built.

The European & North American Railway is completed as a first-class road to Mattawamkeag, 58 miles; about 56 miles remain under contract. The track, bridges and rolling stock are in excellent condition. The 56 miles from Mattawamkeag to the New Brunswick line will be completed the coming summer. When completed, a chain of railway will extend from San Francisco in the west to Halifax in the east, making a line of railway of 306 miles across the State.

The Maine Central, Portland & Kennebec, and Somerset & Kennebec roads are now combined under one management. The Maine Central is now being extended from Danville Junction to Cumberland—18 miles—to connect with the Maine road. After this is done, the gauge from Danville Junction to Waterville will be narrowed to conform with the rest of the road, making a uniform gauge from Bangor to Portland, both by the way of Augusta and Lewiston, and connecting at Portland with the same gauge westward. The Maine Central proper has improved its track during the season. It has laid 650 tons of new rails and relaid about 500 tons of old, built a new truss bridge over Sourdapscook stream, rebuilt the pile bridge at Belgrade, put in 40,000 new sleepers, and graveled about 16 miles of track. The Portland & Kennebec proper, with the Somerset & Kennebec leased by it, has laid 1,100 tons of new iron, 50,000 new sleepers, rebuilt 12 stone culverts, a truss bridge at Falmouth, renewed and strengthened its other bridges, ballasted and raised much of its track, and constructed the magnificent iron bridge at Augusta.

The Dexter & Newport road is operated by the Maine Central. The road has been well cared for in its track and equipment.

The Houlton branch of the St. Andrews road, from New Brunswick to Houlton, has been completed and opened the past season, being the first road into Aroostook County, and enables the shipment of freight, but in the wrong direction.

The Somerset road, extending from its junction with the Maine Central at West Waterville, to Solon and Canatunk Falls, 33 miles, has not yet been completed, but much work has been done upon it, some $335,000 having been expended in labor and material. About 22 miles have been graded, and the abutments to the bridge over the Kennebec, at Norridgewock, are completed. A vigorous prosecution of work is to go on the next season.

The Knox & Lincoln road, extending from Bath to Rockland, has not yet been opened, although near completion. The track is being laid, and much of the rolling stock has been received. It is thought that trains will be put on during the winter to Wiscasset (ten miles), and that the road will be opened to Rockland early next summer.

Several routes for new roads have been projected, and several schemes are now before the Legislature for consideration.

There are 694¾ miles of railroad in the State, 78 of which were built the last year. There are now under construction 186 miles.

Danville, Hazelton & Wilkesbarre.

It is rumored that negotiations are pending for the lease of the Danville, Hazleton & Wilkesbarre Railroad, by the Pennsylvania Railroad Company.

Poughkeepsie & Eastern.

The opening of the first division of this new railroad in Dutchess County, New York, from Poughkeepsie to Stissing, 21 miles, was celebrated on the 24th ult. Stissing is near the Connecticut line.

National Railway of New Jersey.

The *Iron Age* of New York, says:

"The new National Railway between this city and Philadelphia, which is to be opened to business within eighteen months, is to be completed under the direction of Messrs. Moore, Dillon & Co., to whom the contract has been awarded. The road has already been graded throughout its entire length, and the grade nowhere exceeds twenty-five feet to the mile. This is a consideration of first importance, as the slight grade will not seriously interfere with traction on any part of the line, and the company will be able to run fast trains. This it is proposed to do. The running time between this city and Philadelphia—the distance being between 86 and 87 miles—will be exactly two hours, including stoppages, or at the rate of about 43 miles per hour; a speed which, with good road and rolling stock and a system of management perfect in all its details, will be found entirely practicable. A daily through train, making no stoppages and traveling at the average rate of about 45 miles per hour, will be put on as soon as the business of the road justifies the expense.

"In its construction the road is to be very perfect in all respects. It will have double tracks of the best steel rails, and will be stone ballasted throughout its entire length, thus securing freedom from dust in summer. From the outskirts of Philadelphia to the passenger stations located at convenient points, trains will be run through a tunnel, in order that a high rate of speed may be maintained within the city limits. The rolling stock, and especially the passenger cars, will be of the most approved pattern, and nothing essential to the comfort and safety will be neglected."

Lowell & Framingham.

H. W. Phelps, of Springfield, Mass., the contractor, has his forces at work all along the 26 miles of this line, and will have it completed next summer.

Addison County Railroad.

J. W. Phelps has more than 100 men working through the severe weather of winter on this railroad which is to extend from a point on the Rutland & Burlington road near Whiting westward through the southern part of Addison County, Vt., to Larrabee's Point, opposite Ticonderoga, N. Y.

Baltimore & Ohio.

Mr. P. H. Dudley has received instructions from Mr. Latrobe to make a survey of that portion of their Chicago line lying between Akron and Tiffin, Ohio.

Ohio & Michigan.

The contract for preparing the road-bed for the iron, for the entire line, was, on the 26th ult., awarded to S. C. Rose & Co., of Coldwater, Michigan. Their bid was the lowest of over seventy presented. They commenced work on the 7th inst. at Battle Creek, when ground was broken with ceremony and speeches. The work is to be prosecuted vigorously. The line is to extend from Mansfield, O., northwest through Coldwater and Battle Creek to Allegan, Mich., and it is at least probable that the Michigan Lake Shore road, now in operation from Allegan northwestward to Holland, and thence along Lake Michigan through Grand Haven to Muskegon, will be consolidated with it.

Denver & Rio Grande.

It is announced that this company will have eighty miles of narrow-gauge road completed and in operation before July next. Forty miles of iron has been purchased and is expected to arrive in March. The route is from Denver southward, between five and six hundred miles, to El Paso, Texas, passing through the Arkansas Canon and San Luis Park, and down the Rio Grande Valley. The gauge of three feet has been adopted for the mountainous country, requiring steep grades and short curves.

Lafayette, Bloomington & Mississippi.

The report for the year ending January 27, 1871, shows that the receipts for the year from the sale of township bonds, have been $143,127.08, and expenditures for engineering, grading, bridging, right of way, etc., have been $142,891.99.

Mississippi Valley & Western.

The Keokuk *Gate City* announces the incorporation of this new company, whose line is to run from the western end of the Keokuk & Hamilton Bridge to some point on the State line between Iowa and Missouri, within five miles of Alexandria. It is said to be the intention of the corporators, at an early day, to consolidate their road with the Mississippi & Missouri River Air Line Railroad, giving a direct line from Keokuk on the west side of the river to Quincy, and forming an important link in the line to St. Louis.

Boston & Albany.

The completion of the Hoosac Tunnel, an event that is now at last expected with some confidence to occur, will open a new route between Boston and Albany considerably shorter than that by the Boston & Albany Railroad. In anticipation of this, the latter company, it is said, has serious thoughts of constructing a loop line from a point near Albany to Pittsfield, Mass., or to construct a line on an old survey from the State line through West Stockbridge, Lee and Otis to Westfield. Either of these would materially decrease the distance between Albany and Springfield.

St. Louis, Memphis, Nashville & Chattanooga.

Under this title the joint time-tables of the Nashville & Chattanooga and the Nashville & Northwestern railroads are published. Passenger cars are run through without change between Chattanooga and Memphis, and between Chattanooga and Columbus, on the former route using the Louisville and Memphis line into Memphis, and on the latter a part of the Mobile & Ohio.

Connecticut Western.

This railroad will be entirely ready for the track from Millerton, N. Y., its eastern terminus, to Hartford, a distance of 67 miles, by the middle of this month. At Millerton it connects with the Harlem Railroad for New York and Albany, the Dutchess & Columbia for Fishkill, and when they are completed, with lines to Poughkeepsie and Rhinebeck.

Reading Railroad Wharves.

The Philadelphia *Public Ledger* gives the following description of the shipping facilities of the Reading Railroad at its Richmond coal depot in Philadelphia: "It has a wharf frontage on the Delaware of 1½ miles, a harbor for the presence at one time of from 250 to 300 boats, 21 immense wharves, with a dumpage capacity of 200,000 tons, and capable of accommodating 125 vessels. To approach these wharves the premises are net-worked with fron 75 to 100 miles of iron track."

Hannibal & St. Joseph.

Mr. Edward Wilder, Land Commissioner, reports that the sales of railroad land in North Missouri for the month of January were to 23 purchasers, 841.19 acres and 2 town lots, for $9,594.28, or an average of $11.40 per acre.

Lake Shore & Tuscarawas Valley.

This new Ohio road is seeking aid to enable it to build a road from Berea, a station on the Cleveland, Columbus, Cincinnati & Indianapolis road 13 miles from Cleveland, in a southerly direction, through Wadsworth and Massilon to Dennison, in Tuscarawas County, on the Pan Handle line.

Mississippi & Missouri Air Line.

This railroad was opened last week between West Quincy and LaGrange, Mo., about nine miles up the Mississippi.

Wisconsin Central.

The survey of the line between Stevens Point and Portage has been completed, making the distance 71½ miles, which, according to the Chief Engineer, Mr. Wellman, is but 1½ miles longer than an air-line between these points. The country is quite level for 30 miles south of Stevens Point, but in the vicinity of Westfield there is a fall of about 300 feet in ten miles; the heaviest grade being 60 feet to the mile.

Athol & Enfield.

The Springfield *Republican* says that Willis Phelps, of that city, who has the contract for the construction of the above road, has 25 of the 30 miles between Athol and Palmer graded. The rails are shipped from Wales, to arrive in March; track-laying will begin in April, and the entire line from Athol to Enfield is to be completed in June.

Elevated Atmospheric Railroad.

The New York State Senate is considering another elevated railroad. The motive power is to be atmospheric, and it is to run from the east side of the City Hall Park, through Chatham street, Bowery and Third avenue, to the Harlem River. The company is to have the right to charge ten cents fare to the Harlem River, and five cents for shorter distances, and two cents a mile through Westchester County. The capital stock is to be $3,000,000, in shares of $100 each. The corporators named are Jordan L. Mott, Jacob M. Long, John Wilson, John Black, T. P. Whitney, J. McB. Davidson, C. F. Bates, R. H. Gilbert, M. O. Davidson, William Foster, Jr., E. A. Packer, Joel A. Fithian, Thomas Rogers, H. P. Degraff, and several others.

Memphis & Little Rock.

All the law-suits pending between this company and the Memphis, El Paso & Pacific Railroad Company, have been dismissed, and Mr. Wm. B. Greenlaw becomes the owner of the Memphis city stock. The construction is now progressing quite rapidly. At White River the superstructure of the bridge is being put on.

LOCOMOTIVE STATISTICS.

Chicago, Burlington & Quincy.

C. F. Jauriet, General Master Mechanic of this railroad, reports for the month of November, 1870, as follows:

Miles run on passenger trains	105,796
" " freight trains	150,555
" " miscellaneous trains	98,149
Total number of miles run	353,500
Average cost per mile for repairs	10.74 cts.
" " " oil and waste	.90 "
" " " fuel	9.02 "
" " " engineers, firemen and wipers	7.60 "
Total cost per mile run	28.26 cts.

The average number of miles run was

To one ton of coal	49.72
" pint of oil	15.00

Wood is rated at $6 per cord and coal at $4 per ton, loaded on tenders. One pound of tallow is rated as one pint of oil. The number of locomotives reported is 158. Of these eighteen made no mileage during the month, four are rebuilding, five have had general and four light repairs, four have been engaged on the Michigan Central and one on the Quincy & Warsaw road.

Burlington & Missouri River.

Mr. George Chalender, Master Mechanic of the company, makes the following report for the month of December, 1870:

Miles run by passenger trains	40,516
" " freight "	64,656
" " miscellaneous "	27,588
Total number of miles run	132,760

The average cost per mile was:

For repairs	5.29 cts.
" oil, waste and tallow	0.83 "
" fuel	9.21 "
" engineers, firemen and wipers	8.63 "
Total cost per mile run	23.95 cts.

The average number of miles run was:

To one ton of coal	37.33
" pint of oil	14.10

Coal is charged at $3.50 per ton. Fifty-two locomotives made mileage during the month, one was in shop, and one in shop most of the month.

Pittsburgh, Fort Wayne & Chicago.

Mr. S. M. Cummings, Master Mechanic of the Eastern Division, makes the following report for the division for the month of November, 1870:

The number of miles run was, on

Passenger trains	80,492
Freight "	236,156
Wood "	700
Ballast "	9,625
Total	326,973

The cost per mile run was for

Repairs	4.03 cts.
Fuel	6.06 "
Stoves	1.22 "
Engineers, firemen and wipers	7.06 "
Other accounts not included in above	.87 "
Total cost per mile run	19.24 cts.
Miles run to pint of oil	14.15
" " ton of coal	39.48

Three hundred and forty-four locomotives are employed on the division, 6 of these made no mileage during the month, 1 is out of service, 3 were in shop most of the month, and one new locomotive went into service on the 9th.

TRAFFIC AND EARNINGS.

—The following were the receipts of the Great Western Railway of Canada for the week ending Jannary 13th, 1871:

Passengers	$21,655 35
Freight and live stock	70,004 56
Mails and sundries	3,076 13
Total receipts for week	$94,736 04
Corresponding week, 1869	70,574 24
Increase (35 per cent.)	$24,161 80

—The percentage of traffic receipts on the capital expended on English railways was in the first instance very satisfactory, and the working expenses were moderate, being about 40 per cent. In 1842 the traffic receipts on the capital expended amounted to 8.42 per cent., and the profit on capital expended to 4.93 per cent. In 1846 the traffic receipts amounted to 9.05 per cent., and the profit on capital expended to 5.25 per cent. In 1850 the working expenses were 42 per cent., the traffic receipts on the capital expended became rapidly reduced in the interval to 5.70 per cent., and the profit to 3.31 per cent. In 1854 the working expenses amounted to 46 per cent. of the receipts; the traffic receipts on the capital expended gradually rose to 7.30 per cent. The working expenses in 1858 averaged 48 per cent., the traffic receipts 7.46 per cent., and the profit 3.88 per cent. In 1862 the working expenses averaged 48 per cent, of the receipts, the traffic receipts 7.83 per

ent., and the profit 4.07 per cent. The working expenses in 1866 averaged 48.8 per cent., the traffic receipts 8.15 per cent., and the profit 4.17 per cent. And in 1870 the working expenses averaged 48.1 per cent. of the receipts, the traffic receipts on the capital expended 8.65 per cent., and the profit 4.49 per cent., being larger than in any preceeding year since 1847.

—Cotton is now shipped through by rail from Vicksburg to Savannah, whence Murray's steamers take it directly through to Liverpool. The time from Vicksburg to Livorpool by this route is but about 21 days. Vicksburg is likely to become an important cotton point.

—The earnings of the Toledo, Wabash & Western Railway for the month of December, 1870, were $387,254.59, an increase over the same month of last year of $89,676.54.

MECHANICS AND ENGINEERING.

Wooden Railroads.

Mr. C. G. Forshey, a civil engineer in Texas, advocates the construction of narrow-gauge railroads with wooden rails as adapted to thinly populated districts in Texas where traffic is light and it is utterly impossible to get money to construct ordinary railroads. Charters have been obtained for two such roads, and these are likely to be built soon.

A Co-operative Rolling Mill.

A Pennsylvania correspondent informs us that a rolling-mill on the co-operative plan has been organized in Danville, Pa. The stock is divided into 170 shares of $1,000 each. No member is allowed to hold more than five shares. Perry Dean, Esq., has been elected President. He expects to have the mill in full running order by July 1.

Bridge Works in Kansas.

A company known as the "King Wrought Iron Bridge Manufactory and Iron Works" is about to establish extensive works in Iola, Kansas, for the construction of wrought-iron, tubular channel arch bridge patented by Zenas King. The company is composed of the patentee and of Mills & Smith, well known real estate agents of Topeka. It is said that this company will employ from 300 to 500 men and will construct all bridges of this pattern which are erected west of the Mississippi. It is also said that iron works will he connected with the bridge works, in which ore will be reduced and iron rolled. Iola is a small town on the Leavenworth, Lawrence & Galveston Railroad, eight miles north of Humbold, 78 miles south of Lawrence, and 104 miles from Kansas City.

ELECTIONS AND APPOINTMENTS.

—R. W. Smith, formerly Eastern Superintendent of the Empire line, has been appointed Treasurer of the Western & Atlantic Railroad with headquarters at Atlanta.

—S. E. Carey, late General Ticket Agent of the Jeffersonville, Madison & Indianapolis Railroad, and previously of the Mississippi Central, has accpted a similar position on the New Orleans, Jackson & Great Northern road, with headquarters at New Orleans. Mr. Carey is a very capable man and thoroughly acquainted with the field in which his road operates.

—Orland Smith, formerly Master of Transportation of the Marietta & Cincinnati Railroad, has been appointed General Superintendent of the Springfield & Illinois Southeastern Railway in place of F. Dodge, who has been disabled by paralysis. As the road has now 140 miles in operation and will soon have more, it is a position of considerable importance.

—P. S. Danforth succeeds E. H. Dunham, resigned—as Superintendent and Treasurer of the Middleburgh & Schoharie (N. Y.) Railroad.

—John S. Pollard succeeds George C. Ball as Auditor of the Mobile & Montgomery Railroad.

—W. W. Worthington has been appointed Superintendent and General Agent of the Fort Wayne, Muncie & Cincinnati Railroad, with office at Connersville, Ind.

—The following gentlemen were elected directors at the annual meeting of the stockholders of Wells, Fargo & Co.'s Express Company, at the office No. 84 Broadway, New York, on the 6th inst.: Leland Stanford, Wm. G. Fargo, J. C. Fargo, D O. Mills, F. Lloyd Tevis, M. T. Latham, C. P. Huntington, A. H. Barney and B. P. Cheney.

—E. W. Cole, formerly Superintendent of the Georgia Railroad, and now President of the Nashville & Chattanooga and the Nashville & Northwestern Railroad companies, has been appointed General Superintendent of Western & Atlantic Railroad (Chattanooga to Atlanta) under the new lessees. Thus he exercises a superintendence over a line extending from Atlanta to the Mississippi, at Hickman, Ky., only forty miles below Cairo, and only twenty miles from the terminus of the Iron Mountain road at Belmont.

—C. I. Baldwin has been appointed General Southwestern Passenger Agent of the Grand Trunk Railway, with headquarters at St. Louis. Gen. Baldwin formerly represented the same road at Ogdensburg, N. Y.

—J. M. Selkirk succeeds Caleb Bankright as General Superintendent of the Charlotte, Columbia & Augusta Railroad. Mr. Bankright has been appointed Treasurer.

—At the stockholders' meeting of the Montpelier & Wells River Railroad Company, recently held at Montpelier, the old Board of Directors—Roderick Richardson, of Boston; Joel Foster, Jr., Jacob Smith, I. W. Brown and J. G. French, of Montpelier; C. M. Heath, of Plainfield; E. S. Pitkin, of Marshfield; I. N. Hall, of Groton, and G. B. Fessenden, of Wells River—were elected for the ensuing year.

—Otis H. Earle, who was formerly in the service of the Michigan Southern Railroad, has been appointed Superintendent of the Lodge Pole Division of the Union Pacific.

—C. Ketcham, formerly Division Superintendent of the Merchant's Union Express at Toledo, has been appointed Assistant Superintendent of the Union Pacific Express Company.

—O. A. Haynes has been appointed Master Mechanic and Wm. S. Cuddy Paymaster and Purchasing Agent of the St. Louis & Iron Mountain Railroad.

PERSONAL.

—The Reading (Pa.) *Times and Dispatch*, in noticing the election of G. A. Nicholls as Vice-President of the Philadelphia & Reading Railroad Company, says that he will remain General Superintendent of the road. It adds:

"His connection with the road commenced with its beginning, about thirty-five years ago, and has continued without interruption to the present date. No man is more thoroughly acquainted with everything that relates to the important public work, or better able to give intelligent assistance in its general management."

—Mr. Henry R. Pierson, formerly Vice-President of the Chicago & Northwestern Railway Company, and now Vice-President of the Pullman Palace Car Company, has left this city and established his headquarters in New York. His friends at the Pullman offices presented him with a fine gold-headed cane before his removal. Mr. Pierson is an able and a very honorable and upright man.

—Henry C. Lord, late President of the Indiapolis, Cincinnati & Lafayette Railroad Company, makes a long defense of his administration in the Cincinnati papers, drawn out by the recent report of the stockholders reflecting upon his management.

—Mr. A. Caldwell, lately chosen United States Senator from Kansas, is President of the Leavenworth, Atchison & Northwestern Railroad.

—Mr. Charles R. Capron, who last year was agent of the Allentown fast freight line in Chicago, is about to establish an office in St. Paul for the various freight lines running over the Pennsylvania Railroad.

—Mr. A. P. Balch has given up his position as Superintendent of Construction of the Northwestern Construction Company (which has the contract for constructing the Northern Pacific through Minnesota), and Mr. D. C. Shepard, long Superintendent of the Iowa and Minnesota divisions of the Milwaukee & St. Paul Railway, takes his place.

—Daniel Layman, for some time President, and the most persevering promoter of the Connecticut Air Line Railroad, died lately in Middletown, Conn.

—Harry L. Hall, Master of Transportation on the Indianapolis, Cincinnati & Lafayette Railroad, with which road he has been connected for the last sixteen years, has tendered his resignation to take effect as soon as his successor is appointed.

—The Springfield *Republican* after speaking of work under contract to J. W. Phelps and H. W. Phelps of that city, adds: "We haven't heard that Willis Phelps, father of the two sons who are driving this vigorous business at railway construction, has any thought of yielding the palm to them as yet, or retiring from business, though 64 years old. He began as a railroad contractor about thirty-two years ago on the Dalton section of the Western (now Boston & Albany) Railroad, and has been digging road-beds and laying tracks almost uninterruptedly since, stopping at one time and engaging in woolen manufacturing as he 'thought all the railroads were built.' Probably he has built more roads and more miles of road than any other man in the United States."

Chicago Railroad News.

Chicago & Northwestern.

This company has heretofore entered Madison on the track of the Milwaukee & St. Paul Railway. Last summer, when the construction of the Baraboo Air Line was determined upon, it was also decided to complete an independent connection with that road by constructing a track to and through Madison. This track is to extend from Syene, about three miles southeast of Madison, across Third Lake into the city, and is about five miles long. The work on that short line is very heavy. Between Syene and the lake, there is a rock cutting, 2,700 feet long and 40 feet deep! The contract for this work, which is heavier than any other section of like length anywhere on the Northwestern's lines, was let to Mr. Thomas Rock, who completed it last week, after four months' work. Besides this heavy rock cutting, there is a pile bridge, 7,200 feet long, across Third Lake, which Mr. F. E. Canda, of this city, is constructing.

The company is also replacing the bridge over the Rock at Janesville, with a fine iron-deck bridge with two spans 195 feet long and two 119 feet long. Mr. Wheeler Durham is the engineer in charge of the construction of this bridge as also of the Madison line.

The company has also just completed a new draw bridge across the North Branch of the Chicago River.

Another important engineering work, which will become the property of this company, is a permanent bridge over the Mississippi at Winona, the work upon which is already commenced. It will cost about $130,000.

The snow and high winds of the past week have proved a serious obstruction to business. On the Galena division the passenger trains were delayed on Monday and Wednesday and freight trains for a time entirely stopped.

Michigan Central.

While the passenger business continues to be very dull, the freights, moving in both directions, fill all the cars the company can furnish. The earnings for January, on the main line, show an increase of 14 per cent. over those of last year, the increase in freight earnings being about $100,000.

Chicago, Burlington & Quincy.

The following is an account of the receipts from the sale of tickets at the Galesburg office of this road for the past three years: 1868, $121,485.40; 1869, $134,186.25; 1870, $154,214.50. Excess of 1869 over 1868, $12,700.85; excess of 1870 over 1869, $20,028.25.

Personal.

Maurice J. Connell has been appointed agent for Blood's adjustable car seats and for Elliott's elliptic freight car springs, with an office at Nos. 38 and 40 La Salle street, in this city. These springs are manufactured in St. Louis.

Chicago & Alton.

The company is receiving a consignment of "John Brown" steel rails sufficient to lay about 20 miles of track. It is also receiving, by way of New York and New Orleans, a large quantity of "Ebw Vale" iron rails for its new lines.

Illinois Central.

The following is the report of receipts for the month of January, 1871.

LAND DEPARTMENT.

Acres construction lands sold	3,033.77 for	$29,335 93
Acres interest fund lands sold		
Acres free lands sold	208.33 for	4,197 69
Total sales during month of Jan., 1871	3,242.10 for	$33,533 62
To which add town lot sales		500 00
Total of all	3,242.10 for	$34,033 62
Cash collected in January, 1871		$216,429 45

ESTIMATED EARNINGS—TRAFFIC DEPARTMENT.

	In Illinois, 707 miles.	In Iowa, 400¼ miles.	Total. 1107¼ mls
Freight	$362,753 00	$46,971 00	$409,724 00
Passengers	118,383 03	25,058 70	143,441 73
Mails	6,375 00	3,059 33	9,434 33
Other Sources	74,000 00	2,940 67	76,940 67
Total, Jan., 1871	$561,511 03	$78,029 70	$639,540 73
Total actual earnings, Jan., 1870.	$534,884 58	$88,498 88	$623,383 46
Difference	+$26,626 45	−$10,469 18	+$16,157 27

An increase of 5 per cent. on the Illinois lines, a decrease of 12 per cent. on the Iowa lines, and an increase of 2⅗ per cent. in the total earnings.

REGISTER OF EARNINGS.

FOR THE MONTH OF JANUARY.

Michigan Central (284 miles), 1871	$385,409 06
" " (284 miles), 1870	337,992 45
Increase (14 per cent.)	$47,416 61
[The earnings from all sources were $418,755.70 for January, 1871.]	
Chicago & Alton (465 miles), 1871	$343,555 65
" " (431 miles), 1870	281,108 90
Increase (22 per cent.)	$62,446 75
Illinois Central (1,107¼ miles) 1871	$639,540 73
" " (974 miles) 1870	623,383 46
Increase (2⅗ per cent.)	$16,157 27
St. Louis & Iron Mountain (210 miles), 1871	$126,218 00
" " " (210 miles), 1870	92,181 52
Increase (37 per cent.)	$34,036 48
Pacific of Missouri (355 miles) 1871	$212,000 00
" " (355 miles) 1870	202,447 00
Increase (4¾ per cent.)	$9,553 00
Marietta & Cincinnati (251 miles), 1871	$130,883 00
" " (251 miles), 1870	90,177 00
Increase (45⅕ per cent.)	$40,706 00

RAILROAD GAZETTE

PUBLISHED EVERY SATURDAY.

CONTENTS.

INDEX TO RAILROAD ADVERTISEMENTS.

Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

Removal.—The office of the RAILROAD GAZETTE *is removed to Nos.* 110 *and* 112 *Madison Street.*

☞ *Our Prospectus and Business Notices will be found on the last page.*

WARMING AND VENTILATION OF RAILROAD CARS.

That a constant supply of fresh air is absolutely essential for the preservation of health, all who have given the subject very careful consideration are now agreed. Unfortunately, however, very few people have ever given enough attention to it to be able to realize its importance. Air being invisible and only to a limited extent perceptible by the sense of touch, and, when pure, odorless, it has somewhat of an impalpable nature, so that its properties are not readily apprehended. It is inhaled without any conscious effort and performs its function of sustaining health and life in a hidden and seemingly mysterious way. It may be breathed when it is deteriorated to a degree highly injurious to health, and we be insensible to the fact. The worst effects produced by impure air are seldom noticed at the time, and can only be recognized by careful and intelligent observation and deduction. It is perhaps not surprising, therefore, that the importance of breathing pure air is not better understood by the mass of mankind. Multitudes of people do not seem to have any perception of the difference between air which is pure and that which has been contaminated by the breath of others. They cannot *see* the foulness, and therefore do not believe that it exists. A very limited experience in railroad travel will show that of a car-full of passengers the great majority will not only consent to ride for hours without opening the ventilators, but in the cold weather many will *object* to having them opened. Dr. Franklin wrote in one of his letters, "for some are "as much afraid of fresh air as persons in the hydro- "phobia are of fresh water." This is as true at the present day as it was when it was written. Mr. Beecher, in a lecture delivered to medical students in Brooklyn, referred to this subject and said: "The principal "use which men seem to put air to is to destroy "it. They go into their houses and shut out the "exterior air, and burn by stoves that which "is inside, and poison it by breathing, and then, when "it is thoroughly destructive, go on breathing it and "sucking it in as if it were a confection, or a luxury! "Is there anybody that teaches men what air means "when applied to travel in steamboats? It is enough "to set one retching just to remember the cabin! Is "there anybody to teach the community the benefit of "air in railway cars, in churches, in lecture halls, in "places of crowded assemby? We should scorn with "ineffable scorn to sit down at a plate where a man "had just eaten his meal and take the knife that had "just been in his mouth and put it in ours; but we will "sit down and breathe the air that he has breathed, "and that his wife has breathed, and that his "children have breathed, and that the servants have "breathed, and that forty others have breathed, and "will think it just as good for our breathing, and will "breathe it over, and over, and over again, as if it was a "precious morsel. There seems to be no power to "impress men that God made pure air for promoting "health, and that impure air produces sickness.

This lamentable ignorance and indifference will be found everywhere, and unfortunately is not confined to the ignorant classes alone. Very few of the persons who have charge of the cars on our railroads, seem to have any clear ideas of the necessity of ventilation, or of the quantity of fresh air required by each passenger, or of the laws which must be observed in order to supply it. To a certain extent this can be accounted for, it is true, by the uncertainty and indefiniteness which still exists among those who have given most thought and study to the subject. Any one who makes careful investigation of its principles will be astonished to find what a great diversity of opinion exists. The doctors on this, as on everything else, disagree. Some of the books which have been written on the subject advocate special theories or "systems," most of them are superannuated and none exhaustive on the subject, considered in the light of existing science. Much discretion must therefore be exercised in adopting any conclusions, and great care be taken to sift the wheat from the chaff. Many very important questions relating to the subject are still in dispute, and considerable uncertainty exists in relation to others. There are, however, enough well known and easily demonstrated laws which are not disputed, and which, if observed, will insure thorough ventilation.

All physiologists are agreed that oxygen is the element in the atmosphere which sustains life. Without it death ensues, and any reduction of the quantity existing in ordinary air renders the latter unwholesome and unfit to be breathed. Considerable difference of opinion still exists in regard to the effect of breathing carbonic acid. Some assert that it is a positive poison, while others say it is only injurious when combined with other gases, while Professor Huxley says: "It is possible that what appears to be the directly "poisonous effects of carbonic acid may really arise "from its taking up the room that ought to be occu- "pied by oxygen." It is not important, however, for our present purpose to know whether people are injured by too much carbonic acid or too little oxygen. The injurious effect is all that need concern us now. There is no doubt that when air is once breathed, it is deprived of a portion of its oxygen, and its place is filled with very nearly the same quantity of carbonic acid. Professor Huxley's "Elementary Lessons on Physiology" contains the following account of the process of respiration:

"If an adult man breathing calmly in the sitting position be watched, the respiratory act will be observed to be repeated thirteen or fifteen times every minute. * * * At each inspiration about thirty cubic inches of air are inspired, and at each expiration the same, or a slightly smaller volume (allowing for the increase of temperature of the air so expired), is given out of the body.

"The expired air differs from the air inspired in the following particulars:

"1st. Whatever the temperature of the external air, that expired is nearly as hot as the blood, or has a temperature between 90° and 100°.

"2d. However dry the external air may be, that expired is quite, or nearly, saturated with watery vapor.

"3d. Though ordinary air contains nearly 2,100 parts of oxygen, and 7,900 of nytrogen, with not more than 3 parts of carbonic acid in 10,000 parts, expired air contains about 470 parts of carbonic acid, and only between 1,500 and 1,600 parts of oxygen, while the quantity of nitrogen suffers little or no change. Speaking roughly, air which has been breathed once *has gained five per cent. of carbonic acid, and lost five per cent. of oxygen.*

"The expired air contains, in addition, a greater or less quantity of animal matter of a highly decomposable character.

"4th. Very close analysis of the expired air shows, firstly, that the quantity of oxygen which disappears is always slightly in excess of the quantity of carbonic acid supplied; and, secondly, that the nitrogen is variable—the expired nitrogen being sometimes slightly in excess of, sometimes slightly less, than that inspired, and sometimes remaining stationary.

"From three hundred and fifty to four hundred cubic feet of air are thus passed through the lungs of an adult man, taking little or no exercise, in the course of twenty-four hours, and are charged with carbonic acid and deprived of oxygen to the extent of nearly five per cent."

In another chapter of this book, he says:

"It is estimated that, as a general rule, the quantity of water excreted by the skin is about double that given out by the lungs in the same time. The quantity of carbonic acid is not above one-thirtieth or one-fortieth of that excreted by the lungs."

There are also other ingredients of an injurious character exhaled by the lungs, the effects of some of which are not yet clearly understood, but microscopic science is making it daily more probable that the germs of diseases not usually considered contagious are communicated by the human breath. In a recent work by Dr. Beale, in which he describes the nature of disease germs, he says:

"Such minute particles are liable to be suspended in the air we breathe, or they may be disseminated through the water we drink, or hidden in the food we eat. * * * That such particles as those represented are sufficiently light to be supported in the air and carried long distances by air currents, is proved by the fact that the scales of the wings of insects and starch corpuscels, each of which weighs more than a hundred times as much, are supported by the slight currents of air in our ordinary rooms, deposited upon shelves, and even transported long distances."

In another chapter he says:

"In all cases in which disease germs produce their characteristic effects, they reach the blood. Until they have entered the fluid there is no possibility of their exerting any deleterious effects upon the system. Having entered the blood they grow and multiply, and, as we shall see, presently become obstructed in the smaller capillary vessels, which give to each particular contagious fever the characteristics peculiar to it and enable us to recognize and define it.

"Suspended in the air they may pass towards or into the air cells of the lungs at every inspiration, some of the slightest particles might reach the ultimate air cell where an exceedingly delicate membrane, easily penetrated by living particles, alone separates them from the blood.

"If living disease germs fell on the soft mucous lining of the air passages, they would there find a material, if not adapted for their nutrition, at least favorable for preserving them in a living state. Through this they would gradually make their way into the capillary vessels or lymphatics, ramifying in the tissues beneath."

Consider now for a moment the exposure to these germs of disease and death to which travelers are subjected. They are inclosed in an apartment which is often almost hermetically sealed, containing only about 3,000 cubic feet of air with from forty to sixty other people of all conditions of life, who are all liable to, and a portion of whom probably are affected by some of the diseases to which humanity is prone. The air is breathed over and over again, first by one and then another. That which has passed through tuberculous lungs and is filled with their minute exhalations must pass through ours. Throat-diseases, catarrh, fevers, disordered stomachs, and, perhaps, worse than all, personal uncleanliness, each contributes of its impurities. The exhalations from the skin and other portions of the body fill it to repletion with the miasm of disease and death. Remember, too, that the oxygen of the atmosphere is each moment being absorbed and replaced by carbonic acid, sulphur, etc., hydrogen and other matters, and, to quote again from Professor Huxley, "the "persistant breathing of such air tends to lower all "kinds of vital energy, and predisposes to disease." In addition to this, the great and sudden fluctuations in the temperature of the car and the difference between that at the floor and the ceiling, which is often as

much as 50°, and we have conditions than which it would be hard to devise any more favorable for the spread of disease. If, besides, we consider the risks of sleeping in such an atmosphere—of being subject to a violent perspiration one moment, in which the natural impulse is to throw off all the covering or a portion of the clothing, and then being exposed to a wintry freezing blast from an open door the next—and we have a combination of circumstances more productive of disease and death ten times over than accidents are, fearful as is their list of mortality and terrible as are their consequences.

It would not be easy to over-estimate the importance of the subject of ventilation. Nearly one half of the deaths in the city of New York are attributed to bad air, and everywhere death reaps its harvest because people will not breathe fresh air, which we can have in unlimited quantities at any time, *excepting when we travel*. Surely it is time for people who build cars to give some intelligent and earnest thought to the question and to devise some means to remedy the great evil.

TO BE CONTINUED.

The Central Railroad of Iowa.

The completion of this road from Mason City to Albia, Iowa, was celebrated with great enthusiasm at various towns on the line on the 4th inst., when the last rail was laid at a point about fifteen miles south of Grinnell. The event was celebrated as the completion of the railroad, but it was announced last summer that the road would be extended southward from Albia to a connection with the North Missouri Railroad near the State line, probably at Moulton. At the celebration, however, the President of the company announced that trains would be put on "at once" to run through between St. Louis and St. Paul. For this it will be necessary to run over the track of the Burlington & Missouri River Railroad between Albia and Ottumwa, 25 miles. The distance from St. Louis to St. Paul by this route is 640 miles, two-thirds of the distance between Chicago and New York and 200 miles further than the distance between Chicago and St. Paul by the present route.

The lines and distances are:

	miles.
North Missouri, St. Louis to Ottumwa	276
Burlington & Missouri River, Ottumwa to Albia	25
Central of Iowa, Albia to Mason City	195
Milwaukee & St. Paul, Mason City to St. Paul	144
Total	640

This forms the first complete north and south line across Iowa. The Central itself crosses five east and west lines, besides the great diagonal lines of Iowa—the Des Moines Valley road. These crossings are made at Albia on the Burlington & Missouri River, Eddyville on the Des Moines Valley, Grinnel, on the Chicago, Rock Island & Pacific, Marshalltown on the Chicago & Northwestern, Ackley on the Dubuque & Sioux City, and Mason City on the Iowa & Dakota line of the Milwaukee & St. Paul.

This road is a road for north and south traffic, and will be more valuable to St. Louis than to Chicago, or any other eastern city. The comparative distances to St. Louis and Chicago from the chief towns on its lines are as follows:

	To St. Louis.	To Chicago.
Albia	301 miles.	307 miles.
Eddyville	3 4 "	298 "
Oskaloosa	324 "	306 "
Grinnell	337 "	302 "
Marshalltown	383 "	289 "
Eldora	411 "	317 "
Ackley	455 "	320 "
Mason City	501 "	366 "

The distances, it will be observed, except at the southern terminus, are everywhere in favor of Chicago, but for most of the towns the difference is not so great as to affect trade materially. The business, doubtless, will be controlled by the city which can offer the greatest advantages aside from freights; and we do not think that any considerable part of it will be diverted from Chicago to St. Louis until, at least, the latter city has driven us out of the other districts much nearer to it, in North Missouri and Kansas, whose trade, to a large extent, Chicago now commands.

But the new line is fortunate in having no rival—at the present—and there should be business enough between the Mississippi and the Missouri, in the direction of its length, to give it a good traffic. It has great coal mines on its line, and there is a great market for lumber everywhere on its line, and on its southern connections, which it can carry from Minnesota. The country on the line is like the rest of Iowa, fertile as a garden, and cultivable almost to the last acre, and for most of the way it is well settled, and everywhere growing fast. It is fortunate in having friendly relations with companies to the north and south, so that it can provide the best facilities for a through business.

In the table of distances given above, we have estimated a few of those from St. Louis, not knowing the exact length of the railroad and distances between stations from Albia to Grinnell, but they cannot be more than a few miles from the exact distances. If the company construct the line from Albia to Moulton, all the distances from St. Louis will be decreased by about 33 miles.

The Proposed Railroad Commissioners.

We publish elsewhere the text of the bill providing a railroad commission for Illinois, which Hon. A. C. Fuller has introduced into the Senate. We also give the form of railroad report prescribed by the Massachusetts Railroad Commissioners for use in that State.

We believe that any policy which will enable the community to understand the business of transportation will work good and not evil to the railroad companies, however vexatious and unnecessary some of its details may be. The people of the State are not half so unreasonable as they seem to be, or as their representatives would make them appear. If they make unreasonable demands and complaints, it is chiefly because they are not able to ascertain what is reasonable, and make a case from bare supposition and not from facts. Nothing will so completely dispose of most of the staple complaints against railroad companies as a complete exposition of the facts relating to their operations and the principles which govern them. It will be easy to show that this business of transportation has been no more profitable than the average of enterprises in which capital is invested, while there is none which can compare with it in the benefits which it has conferred upon the community.

But an inquisition is not necessarily an investigation. When the State approaches the railroad companies it should consider them as enterprises of moment, legitimate as any industry, more important than any other to foster, whose relations with the community should be harmonious, and which should be defended from injustice while forbidden to act unjustly. That is, it should be remembered that railroad companies have rights as well as duties, and that they deserve just as much consideration as individuals or other corporations. The proposed law seems to look upon railroad companies as natural enemies of the community, against whom the State must provide an army of defence. However, as this is almost the first intimation that the Legislature thinks it advisable to procure some information concerning railroad business before it begins to manage it, it must be considered a favorable indication.

Extended Jurisdiction.

Mr. J. N. McCullough, General Manager of the Pittsburgh, Fort Wayne & Chicago Railway and its leased lines, including the Cleveland & Pittsburgh and the Grand Rapids & Indiana roads, has, we learn, been appointed General Manager also of the Pittsburgh, Cincinnati & St. Louis Railway and its leased lines. This, we believe, gives Mr. McCullough the management of more miles of railroad than were ever before operated by one man. The Fort Wayne road is 468 miles long, the Grand Rapids & Indiana 200 miles, and the Cleveland & Pittsburgh (with branches) 203 miles long, making 871 miles in the Fort Wayne system. The Pittsburgh, Cincinnati & St. Louis Railway with its leased lines comprises 1,129 miles of road; so Mr. McCullough will direct the opeyation of exactly 2,000 miles of road. The different lines form a great system converging at Pittsburgh, with such places as Cleveland, Columbus, Cincinnati, Fort Wayne, Grand Rapids, Indianapolis, and Chicago as stations, extending into or through Illinois, Indiana, Michigan, Ohio and Pennsylvania.

It certainly is a high compliment to Mr. McCullough that the Pennsylvania Company, whose relations with the Fort Wayne road before the lease were not always entirely harmonious, should not only retain him in the management of that line after the lease, but should also give into his charge another and a still more extensive system, so that his jurisdiction is now more extensive than that of any other operating officer in the service of the company.

Mr. McCullough, we believe, will enter upon his duties as General Manager of the Pittsburgh, Cincinnati & St. Louis Railway on the 1st of March next.

The Hudson River Accident.

The terrible accident which occurred this week on the Hudson River Railroad, by which a car load of passengers were actually burned alive, has provoked much discussion and some investigation. The facts seem to be that by the breaking of an axle an oil car was thrown from the down track and across the up track, and that almost immediately, before a signal could be sent forward, an express rushed up the up track at the rate of thirty miles an hour, dashed into the oil car, and was itself thrown from the track and over a bridge with several of its cars covered with oil and enveloped in flame.

There has been some disposition to blame the company for not providing a greater number of signal men; but it does not appear that any signal could have been given after the up track was obstructed which would have stopped the express in time. The true cause of the accident, so far as the facts reported indicate, was the breaking of the axle, and this is the subject which should be investigated, and on the solution of it the guilt or innocence of the company depends. Certainly the subject deserves the most rigid investigation. Some serious accidents have occurred lately in England from this cause, and it has always been one of the most frightful causes of accident everywhere. We hope this fearful accident may stimulate the investigation of the subject and lead to the discovery and the adoption of means which may prevent or materially diminish such accidents in the future.

The Leaverworth, Lawrence & Galveston Railroad.

This line, one of the "border" lines of the United States, is likely to assume an exceptional importance by reason of an extension soon to be made which will give it a large share of the great cattle traffic of the Southwest. It is known that it was originally intended to extend the road southwest through the Indian Territory and Texas to the Gulf, as its name indicates, and this intention remains; but the immediate step to be taken in order to secure the cattle traffic is, comparatively, a new design, which promises, by a moderate expenditure and with little delay, to bring this road directly in contact with the great cattle trail as it now exists.

The road has been in operation some time to a station named Thayer, 110 miles south of Lawrence, 135 miles from Kansas City, and about 35 miles north of the Indian Territory in the valley of the Verdigris.

From this point a line is to be constructed westward 50 or 60 miles to or nearly to the Arkansas River, intersecting the great Texas cattle trail to Abilene not far from Wichita, and nearly a hundred miles from Abilene. The distance thence to Kansas City will be less than 200 miles, and but 30 or 40 miles greater than the distance from Abilene. Moreover this extension, which eventually will be a branch of the main line, will pass through or near a great Indian reservation but lately opened to settlers, to which immigrants are flocking in swarms. So it is likely to have from the beginning both a good local and a good through traffic.

Indeed the immigration to Kansas, which promises to be even greater this season than it was last, and which last season was unsurpassed in the annals of any agricultural state, is likely to give heavy business to most of the new railroads in Kansas, and to this more than to most others. The new line is to begin immediately and to be completed in April, so that it will be ready to transport cattle almost as soon as driving is begun, and this early completion will also enable it to transport immigrants when they are arriving most plentifully.

No new railroad that we know is better prepared to do business. Its rolling stock, in large part manufactured at the Aurora shops of the Chicago, Burlington & Quincy Railroad, would be considered elegant on any line in America, and the road is managed with great skill and energy. Few new lines have become so widely known in so short a time, and the preparations for business this season are likely to make it still more important as the receiver of a staple freight which is carried through to the Atlantic.

The Pennsylvania and the Union Pacific.

A report is current that the Pennsylvania Railroad Company has obtained a controlling interest in the Union Pacific Railroad, and that at the election next March, J. Edgar Thomson, Thomas A. Scott, Andrew Carnegie and George M. Pullman will go into the directory and that Thomas A. Scott will be made President.

If there is truth in this report, the Pennsylvania Company will be likely to control all the trans-continental traffic for many years to come. It has a large interest in the Kansas Pacific Company, and it was understood that by its aid and influence this road was pushed through to Denver last year. It, or some of its managers, has been a prime mover in obtaining the franchises and securing the commencement of the Northern Pacific road. It will be many years, at least, before there is any other line across the continent, and meanwhile the Pennsylvania may be able to secure for its

own lines east of the Missouri the transportation of nearly all the Pacific coast traffic. This is not now a very heavy business, and it is not likely to be until the population of that coast increases to a number much greater than the 650,000 shown by last year's census, or until there has been a very great increase in the trade with Japan, China and Australia.

Steamer Lines Between New York and Europe.

The information given below we obtain from an article in the New York *Herald:*

During 1870 the Cunard Company employed 25 steamers on the line between New York and Liverpool, which made 125 passages each way, carried 250,000 tons of freight from New York to Liverpool and 200,000 tons from Liverpool to New York, and transported 9,156 cabin and 34,525 steerage passengers from Liverpool to America, and 6,270 cabin and 5,150 steerage passengers from New York and Boston to Liverpool. It added five vessels to its stock during the year.

The Anchor Line employed 28 steamers running between New York and Glasgow, calling at Londonderry to receive and land passengers. It connects with steamers to four Scandinavian ports, and also with a line to Mediterranean ports. The steamers of the line made 102 passages from New York to Glasgow in 1870, and 103 from Glasgow and the Mediterranean to New York, with cargoes averaging about 1,500 tons. It brought to New York 31,437 passengers, and carried from it 8,189—2,095 cabin and 6,094 steerage. It has six new steamers under way on the Clyde, three of which will be very large and fine.

The Hamburg-American Packet Company, which runs steamers between New York and Hamburg, touching in time of peace at Havre, has seven steamers, which made 89 trips between New York and Hamburg in 1870; the blockade of the Elbe preventing their running in July, August, and September.

The line carried 870 first-cabin, 2,322 second-cabin, and 19,174 steerage passengers from Europe to New York, and 1,213 first-cabin, 1,230 second-cabin, and 3,284 steerage passengers from New York to Europe. It brought about 40,000 tons of freight to New York. The company will soon have a new line of three steamers running between Hamburg, Havre, New York and New Orleans, and another line of three vessels between Hamburg and Aspinwall, making monthly trips.

The General Transatlantic Company had four steamers which made 25 passages each way between New York and Havre. It carried 3,650 passengers (all cabin) to France and 3,380 to New York during the year. The passenger business and most of the westward freight business was almost destroyed by the war, and the principal freight to France has been munitions of war.

The National Line had ten large and powerful steamers, which made during the year 64 voyages from Liverpool to New York and 63 voyages from New York to Liverpool. They brought to New York 2,488 cabin and 36,955 steerage passengers, and 117,492 tons of cargo. From New York they carried 1,271 cabin, and 3,437 steerage passengers, and 251,653 tons of cargo. The company is constructing two new and very large steamers.

The North German Lloyd had during the first half of the year twelve steamers making semi-weekly trips between New York and Bremen, but the war made it so dangerous to run these steamers that they were laid up from the middle of July to the 1st of October, since which time weekly trips have been made.

During the year 56 trips have been made each way. From New York to Bremen the steamers carried 2,914 cabin and 5,107 steerage passengers—total, 8,021; from Bremen to New York they brought 5,148 cabin and 22,150 steerage passengers. The cargoes have averaged about 1,300 tons to each vessel.

The Williams & Guion Line has had eight steamers, which made 55 trips each way between New York and Liverpool in 1870, conveying to New York 1,538 cabin and 27,792 steerage passengers, with cargoes amounting to 78,620 tons, weight and measurement. From New York to Europe the steamers carried 1,240 cabin and 4,358 steerage passengers, and 71,673 tons weight in cargoes.

The Inman Line employed during the year thirteen vessels, which made during the year 89 voyages each way, bringing to New York about 4,000 cabin and 45,000 steerage passengers, and from New York to Europe, 3,400 cabin and 6,500 steerage passengers; making a total of 58,900 persons, while the cargoes to New York amounted to about 90,000 tons, and from New York to 80,000 tons.

Altogether, during the year 1870, there were 197 steamers plying between New York and European ports, and these carried 302,148 passengers, and 1,691,538 tons of freight.

Contributions.

RELATIONS OF TRAINS TO CURVES.

BY S. J. WALLACE.

Curves are requsite elements of railways, and they involve the provision of certain elements in trains. These are:—provision for keeping on the line of track, as flanges on the wheels; provision for bending the train around curves, as forming it in jointed sections; provision between the sections for the draft; and provision between the sections for resistance, as bumpers.

Draft is an element which must be extended throughout the train, reach in a vertical line from the locomotive and must have strength equal to the strains.

The frame-work of the separate sections, or cars, may be made to serve as parts of the line of draft through the train, special parts may be provided for the purpose, and arranged in jointed parts, to which each car may be secured, leaving the car frames free from the strain.

The line of draft, whatever be its construction, should pass in a direct line from the locomotive through the train. It may pass through any portion of the cross section of the cars. But if it is not virtually in the center line of resistance—that is, with all its joints and weak points in that line—then a strain will be thrown on one side and cause the flanges of its wheels to act against the rail with a resistance to balance the two sides. This will cause loss of power, besides the wear and tear.

On curves a simple direct line of draft cannot pass through the train. A consequent loss of power would occur on the inside rail by the strain of the engine to straighten the train, but for the composition of forces. The impetus tends to throw the train against the outside rail, in the effort to pursue a straight course. In such case, if the engine exert no new power the train will lose force against the outer rails; and if the train were stopped on the curve, the engine in starting would have resistance from the inner rail. On all curves this composition of the two forces takes place. If the speed of train and the exertion of engine are in right proportions to each other and the curve, the curvature of the course becomes a natural result of the united forces, without loss of power. But if the engine exert too much effort on a curve when the speed is too low, the tendency is to drag on the inner rail and to turn a short curve; and if the speed be too high with the engine too slack, the tendency is to drag the outer rail and to turn a large curve; while, if either rail drag, there is a loss of motive power.

The line of draft should be in the vertical plane of the center of resistance in the train, on straight lines. On curves the height of the line of draft is important. If it was several feet high, too great a strain toward straightening the train on a curve might turn the cars over to the inside of curve. But if it were in line between the two rails it would be impossible, because the rail would lie in its direct line of strain. Thus the lower the line of draft can be placed in the train, the more secure it is. This is also nearer the true line of resistance.

In passing curves with speed, heavily loaded cars will be thrown against the outer rail with force, while empty ones may be drawn against the inner rail by the force of the draft.

When the force of the engine is exerted on curves, the tendency is to throw the pair of wheels at each end of the train against the outer rail, and to draw those in the body of the train to the inner rail.

The requisite provision between the sections of a train to resist the impact of mass motion between the cars should be at, or as near as may be to, the center of the weight of the cars, and should act upon the main frame of the car sufficiently to communicate requisite impulse to the weight. But it is a question whether it might not be better to use a special part to communicate the action through the train, and thus free the car-frame from all the strain and shock except the separate shares of each. On curves the action of such bumpers is better to be arranged to act at or toward the inner side of the train.

Car wheels have been made with conical treads to assist them in passing curves without slipping. But as it is very uncertain which rail they will be forced against this becomes an evil, because the wear and tear of wheel and rail is increased by the greater amount of slip required when the large part of the cone is thrown on the inside rail. Besides, level tread wheels have been found to avoid the excessive rocking motion of trains, resulting from the alternate action of the cones on each side.

This partial review of the relations of trains to curves is intended merely to assist practical men to master the running of their trains, to assist engineers of construction, railway companies and inventors in understanding the forces they have to do with, and to assist science in grasping great problems.

THE STATE AND THE RAILROADS.

To the Editor of the Railroad Gazette:

There are few subjects more important or more closely connected with the prosperity of this country, than that of railroad economy. It embraces not only mechanical improvements in construction and equipments, but enters very largely into the policy to be pursued by the State or General Government; at least, so far as legislation can offer inducements for the investment of capital, and to render railroads, in the highest degree safe and effective. Public highways, of every description should have the fostering care of government. Turnpike roads or plank roads, can be very easily controlled, but with railroads, so numerous are the circumstances affecting their construction and operation that it is next to impossible to frame laws which would not operate so unequally in various instances as to prove injurious to the public interest. Take for example, the conditions of passenger traffic. Railroad companies seek the patronage of the traveling public, and consequently, vie with each other in the amount of comfort and luxury they can offer. High speed, Pullman sleeping cars, palace dining cars and elegant outfits of every discription are provided at a great sacrifice. Everywhere, on our great through lines, these attractions are extensively advertised. Diminish, however, the rate of fares, and the comfort of the traveler will be diminished in the same proportion, particularly on roads with light traffic. High speed alone is a great source of expense in the operation of railroads. The difference between 40 miles per hour and 20 being, in the opinion of some well-informed railroad men, as four to one! And yet it is very common to hear travelers grumbling, when running from 20 to 25 miles an hour, at the slow progress of the train. Railroad companies must discriminate in this respect, as well as in many other matters, in the operation of their roads, or give up the idea of paying any dividends. That they frequently run slow trains and charge high rates, cannot be denied; but any arbitrary law fixing their prices is sure to be a damage to the general interest. The law of competition is the great and only effective influence that can permanently bring down the cost of transportation, either of passengers or freight, to its true standard. Mr. Fuller's bill, rigidly carried out, amounts, virtually, to taking the management of railroads out of the hands of the companies, whose property is already heavily taxed. A collusion between a railroad company and the owner of a warehouse is a conspiracy to defraud, but the rates charged for passengers or freight are as legitimate as the prices a merchant fixes on his goods. Our Legislature has granted numerous charters for the construction of railroads, and has endeavored to promote competition by granting the right to municipalities to tax themselves for this desirable object. Although much abused, this privilege has been made available to a large part of the community. Is not our General Assembly bound, in justice to the remainder, who through the intervention of the Constitutional Convention were deprived of the means to construct several important competing roads, to make some rational compensation? Not only will a stringent law operate severely on every new road that has escaped falling into the hands of existing monopolies and has come into a feeble state of existence, but it will discourage every new attempt by individual enterprise, while it excludes capital, which is already only obtained with great difficulty. Some remedy should be devised to guard against the inevitable consequences of imposing burthensome restrictions upon railroads.

The proposed commissioners should be invested with extensive discretionary powers, and, however strict the accountability they must be held to, they should be able to protect the weaker enterprises by all rational drawbacks. To do this, the commission should be composed of men thoroughly versed, by actual experience in the management of railroads, men who have held positions on long lines with heavy traffic, by which they have become aware of every practical difficulty in their management. In addition, however, to this essential feature in carrying out any new law the General Assembly may enact, it is to be hoped that they will have the true interest of the people sufficiently at haert to pass a general railroad law, giving the greatest encouragement and facilities for the construction of competing railroads.

R. P. Morgan.

The Kentucky Legislature has again refused to grant a charter to the Cincinnati Southern Railroad Company. It is said, however, that Congress will grant a charter for the company whenever the matter is urged.

The Proposed Illinois Railroad and Warehouse Commissioners.

The following is Hon. A. C. Fuller's bill to establish the Board of Railroad and Warehouse Commissioners, ntroduced in the Senate February 3:

A Bill for an Act to Establish a Board of Railroad and Warehouse Commissioners and Prescribe their Powers and Duties.

SECTION 1. *Be it enac'ed by the people of the State of Illinois, represented in the General Assembly*, That a commission which shall be styled the Railroad and Warehouse Commission shall be appointed as follows: Within twenty days after this act shall take effect, the Governor shall appoint three persons as such commissioners, who shall hold their office until the next meeting of the General Assembly, and until their successors a e appointed and qualified. At the next meeting of the General Assembly, and every two years thereafter, the Governor, by and with the consent of the Senate, shall appoint three persons as commissioners, who shall hold their offices for the term of two years from the 1st day of January in the year of their appointment, and until their successors are apointed and qualified.

SEC. 2. No person shall be appointed as such commissioner who is, at the time of his appointment, in any way connected with any railroad company or warehouse, or who is directly or indirectly interested in any stock, bond, or other property of, or is in the employment of, any railroad company or warehouse; and no person appointed as such commissioner shall, during the term of his office, become interested in any stock, bond, or other property of any railroad company or warehouse, or in any manner be employed by or connected with any railroad company or warehouse. The Governor shall have the power to remove any such commissioner at any time, in his discretion.

SEC. 3. Before entering upon the duties of his office, each of the said commissioners shall make and subscribe, and file with the Secretary of State, an affidavit in the following form: "I do solemnly swear (or affirm, as the case may be) that I will support the Constitution of the United States, and the Constitution of the State of Illinois, and that I will faithfully discharge the duties of the office of Commissioner of Railroads and Warehouses according to the best of my ability."

SEC. 4. Each of said commissioners shall receive for his services a sum not exceeding five thousand dollars per annum, payable quarterly. They shall be furnished with an office, office furniture, and stationery, at the expense of the State, and shall have the power to appoint a secretary to perform such duties as they shall assign to him. Said secretary shall receive for his services a sum not exceeding two thousand dollars per annum. The office of the said commissioners shall be kept at Springfield, and all sums authorized to be paid by this act shall be paid out of the State Treasury, and only on the order of the Governor.

SEC. 5. The said commissioners shall have the right of passing, in the performance of their duties concerning railroads, on all railroads and railroad trains in this State, free of charge.

SEC. 6. Every railroad company incorporated or doing business in this State, or which shall hereafter be incorporated or do business under any general or special law of this State, shall, on or before the 1st day of September, A. D. 1871, and on or before the same day each year thereafter, make and transfer to the commissioners appointed by virtue of this act, in Springfield, a full and true statement, under oath, of the proper officers of said corporation, of the affairs of their said corporations, as the same existed on the 1st day of the preceding July, specifying:

1. The amount of the capital stock subscribed, and by whom.
2. The names of the owners of its stock, and the amount owned by them respectively, and the residence of each stockholder, as far as known.
3. The amount of stock paid in, and by whom.
4. The amount of its assets and liabilities.
5. The names and places of residence of its officers.
6. The amount of cash paid to the company on account of the original capital stock.
7. The amount of funded debt.
8. The amount of floating debt.
9. The estimated value of the road-bed, including iron and bridges.
10. The estimated value of rolling stock.
11. The estimated value of stations, buildings and fixtures.
12. The estimated value of other property.
13. The length of single main track.
14. The length of double main track.
15. The length of branches, stating whether they have single or double track.
16 The aggregate length of siding and other tracks not above enumerated.
17. The number of miles run by passenger trains during the year preceding the making the report.
18. The number of miles run by freight trains during the same period.
19. The number of tons of through freight carried during the same time.
20. The number of tons of local freight carried during the same time.
21. Its monthly earnings for the transportation of passengers during the same time.
22. Its monthly earnings for the transportation of freight during the same time.
23. Its monthly earnings from all other sources respectively.
24. The amount of expense incurred in the running and management of passenger trains during the same time.
25. The amount of expense incurred in the running and management of freight trains during the same time, and also the amount of expense incurred in the management of mixed trains during the same time.
26. All other expenses incurred in the running and management of the road during the same time, including the salaries of officers, which thall be reported separately.
27. The amount expended for repairs of road and maintenance of way, including repairs and renewal of bridges, and renewal of iron.
28. The amount expended for improvements, and whether the same are estimated as a part of the expenses of operating or repairing the road, and, if either, which.
29. The amount expended for motive power and cars.
30. The amount expended for station-houses, buildings and fixtures.
31. All other expenses for maintenance of way.
32. All other expenditures, either for the management of road, maintenance of way, motive power and cars, or for other purposes.
33. The rate of fare for passengers for each month during the same time—through and way passengers separately.
34. The tariff of freights, showing the change of tariff during the same time.
35. A copy of each published rate of fare for passengers, and tariff of freight, issued for the government of its agents during the same time.
36. Whether the rate of fare and tariff of freights in such published lists are the same as those actually received by the company during the same time. If not, what were received.
37. What express companies run on its road, and on what terms and on what conditions; the kind of business done by them, and whether they take their freights at the depots, or at the office of such express companies.
38. What freight and transportation companies run on its road, and on what terms.
39. Whether such freight and transportation companies use the cars of the railroads, or the cars furnished by themselves.
40. Whether the freight or cars of such companies are given any preference in speed or order of transportation, and, if so, in what particular.
41. What running arrangements it has with other railroad companies, setting forth the contracts for the same.

SEC. 7. The said commissioners may make and propound to such railroad companies any additional interrogatories, which shall be answered by such companies in the same manner as those specified in the foregoing section.

SEC. 8. Section 7 of this act shall apply to the president, directors, and officers of every railroad company now existing, or which shall be incorporated or organized in this State, and to every lessee, manager, and operator of any railroad within this State.

SEC. 9. It shall be the duty of every owner, lessee, and manager of every public warehouseman in this State to furnish, in writing, under oath, at such times as said Railroad and Warehouse Commissioners shall require and prescribe, a statement concerning the condition and management of his business as such warehouseman.

SEC. 10. Such commissioners shall, on or before the 1st day of December in each year, and oftener, if required by the Governor so to do, make a report to the Governor of their doings for the preceding year, containing such facts, statements, and explanations as will disclose the actual workings of the system of railroad transportation and warehouse business in their bearings upon the business and prosperity of the people of this State, and such suggestions in relation thereto as to them may seem appropriate, and particularly, first, whether, in their judgment, the railroads can be classified in regard to the rate of fare, and freight to be charged upon them, and, if so, in what manner; second, whether a classification of freight can also be made, and, if so, in what manner. They shall also, at such time as the Governor shall direct, examine any particular subject connected with the condition and management of such railroads and warehouses, and report to him in writing their opinion thereon, together with the reasons therefor.

SEC. 11. Said commissioners shall examine into the condition and management, and all other matters concerning the business of railroads and warehouses in the State, so far as the same pertain to the relation of such roads and warehouses to the public, and to the accommodation and security of persons doing business therewith, and whether such railroad companies and warehouses, their officers, directors, managers, lessees, agents and employes, comply with the laws of this State, now in force, or which shall hereafter be in force, concerning them; and whenever it shall come to their knowledge, either upon complaint or otherwise, or they shall have reason to believe that any such law or laws have been or are being violated, they shall prosecute, or cause to be prosecuted, all corporations or persons guilty of such violation.

SEC. 12. Said commissioners are hereby authorized to hear and determine all applications for the cancellation of warehouse licenses in this State, which may be issued in pursuance of any law of this State, and, for that purpose, to make and adopt such rules and regulations concerning such hearing and determination as may by them from time to time be deemed proper. And if, upon such hearing, it should appear that any public warehouseman has been guilty of violating any law of this State concerning the business of public warehousemen, said commissioners may cancel and revoke the license of said public warehouseman, and immediately notify the officer who issued such license of such revocation and cancellation. And no person whose license as a public warehouseman shall be cancelled or revoked, shall be entitled to another license to carry on the business, in this State, of such public warehouseman, until the expiration of six months from the date of such revocation or cancellation, and until he shall be again licensed. *Provided*, that this section shall not be so construed as to prevent any such warehouseman from delivering any grain on hand at the time of such revocation or cancellation of his said license. And all licenses issued in violation of the provisions of this section shall be deemed null and void.

SEC. 13. The property, books, records, accounts, papers, and proceeds of all such railroad companies, and all public warehousemen, shall, at all times during business hours, be subject to the examination and inspection of such commissioners, and they shall have power to examine, under oath or affirmation, any and all directors, officers, managers, agents, and employes of any such railroad corporation, and any and all owners, managers, lessees, agents, and employers of such public warehouse, and other persons, concerning any matter relating to the condition and management of said business.

SEC. 14. In working any examination as contemplated in this act; or for the purpose of obtaining information persuant to this act, said commissioners shall have the power to issue subpœnas for the attendance of witnesses, and may administer oaths. In case any person shall fail or refuse to obey such subpœna, it shall be the duty of the Circuit Court of any county upon application for the said commissioners, to issue an attachment for each witness, and compel such witness to attend before the commissioners and give his testimony upon such matters as shall be lawfully required by such commissioners, and the said court shall have power to punish for contempt as in other cases of refusal to obey the process and order of such court.

SEC. 15. Any person who shall neglect or refuse to obey the process of subpœna issued by said commissioners, and appear and testify as therein required, shall be deemed guilty of a misdemeanor, and shall be liable to an indictment in any court of competent jurisdiction, and, on conviction thereof, shall be punished for such offence by a fine of not less than $25 nor more than $500, or by imprisonment of not more than thirty days, or both, in the discretion of the court, before which such conviction shall be had.

SEC. 16. Every railroad company, and every officer or employe of any railroad company, and every owner, lessee, manager, agent, or employe of said warehouse, who shall willfully neglect to make and furnish any report required in this act, at the time herein required, or who shall willfully and unlawfully hinder, delay or obstruct said commissioners in the discharge of the duties hereby imposed upon them, shall forfeit and pay a sum of not less than $100, and not more than $5,000, for each offense, to be recovered in an action of debt, in the name and for the use of the people of the State of Illinois, and every railroad company, and every officer, agent, or employe of such railroad company, and every lessee, manager, or agent, or employe of any public warehouse, shall be liable to a like penalty for every period of ten days after the time it or he shall wilfully neglect or refuse to make such report.

SEC. 17. It shall be the duty of the Attorney General and the State's Attorney in every circuit or county, on the request of said commissioners, to institute and prosecute any and all suits and proceedings which they shall be directed by said commissioners, to institute and prosecute for a violation of this act, or any law of this State, concerning railroad companies or warehouses, or the officers employed, owners, operatives, or agents of any such companies or warehouses.

SEC. 18. All such prosecutions shall be in the name of the people of the State of Illinois, and all moneys arising therefrom shall be paid into the State treasury by the Sheriff, or other officer collecting the same, and the State's Attorney shall be entitled to receive for his compensation from the State treasury, on bills to be approved by the Governor, a sum not exceeding 10 per cent of the amount received and paid into the State treasury as aforesaid. *Provided*, this act shall not be construed to prevent any person prosecuting any *qui tam* action, as authorized by law, and of receiving any such part of the amount recovered under any law of this State.

SEC. 19. This act shall not be so construed as to waive or affect the right of any person injured by the violation of any law in regard to railroad companies or warehouses, from prosecuting for his private damages in any manner allowed by law.

MISCELLANEOUS.

—"A Locomotive Engineer" in the London *Times* speaks of the plan pursued when her Majesty traveled over the Midland line being the best for safety. The plan he says, was to have signalmen at every quarter of a mile. This has been done in every case when the Queen goes to Balmoral, and is the daily custom on many European lines.

—The Keokuk *Gate City* says that that city is to have a grand union depot near the elevator, for use of the six railroads converging there, being the Chicago, Burlington & Quincy; Toledo, Peoria & Warsaw; Des Moines Valley; Iowa Northern and St. Louis & Keokuk. Twenty-five acres of ground will be "made" out of the river, and the depot is to be four hundred feet long, and will involve the expenditure of at least $350,000.

—There is a rumor that a strong Western railroad company is negotiating for the purchase or lease of the Erie Railway; but with whom will it negotiate, and can the managers deliver those "appurtenances" which aid so powerfully in maintaining a "stable" management?

—A bill passed the House of Representatives at Washington, January 17, provides "that no railroad company within the United States whose road forms any part of a line over which cattle, sheep, swine, or other animals, shall be conveyed from one State to another, or the owners or masters of steam, sailing or other vessels carrying or transporting cattle, sheep, swine or other animals from one State to another, shall confine the same in cars, boats or vessels of any description for a longer period than twenty-eight consecutive hours without unloading the same for rest, water and feeding, for a period of at least five consecutive hours, unless prevented from so unloading by storm or other accidental causes." The penalty for a violation of this provision is $100 to $500.

NEW PUBLICATIONS.

Van Nostrand's Engineering Magazine for February has an unusual amount of matter interesting to railroad engineers. One of these articles, which we copied last week, is the paper which Mr. Charles Paine, Chief Engineer of the Lake Shore & Michigan Southern Railway, read before the American Institute of Civil Engineers, on the "History of the Iron Rails upon the Michigan Southern & Northern Indiana Railroad," with comments thereon by another engineer. Such papers as these are of the greatest value, and we wish that similar records were made and published by all companies, with the different kinds of iron and steel carefully distinguished. The *Magazine* also republishes from *The Engineer* two articles on "Locomotive Improvement," which we have published heretofore; an article from the *Journal of the Society of Arts*, on the "Causes of Railway Axle Fracture and the Remedy," which we copy, and a large number of other articles interesting to engineers.

Pekin, Lincoln & Decatur.

There are now two trains daily, each way, on this road, running between Pekin and Delavan, both of which carry passengers. These trains leave Pekin at 1 a. m. and 4 p. m., and reach Delavan at 9:25 a. m. and 5 p. m., respectively. They leave Delavan at 5:20 p. m. and 9:50 a. m., and reach Pekin at 6:30 p. m. and 11 a. m.

The following are the stations, and distances from Pekin, on this road:

Pekin	0 miles	Phillips	14 miles
Weyrich	7 "	Holmes	15 "
Green Valley	11½ "	Delavan	17 "

Marquette & Houghton.

Both houses of the Wisconsin Legislature have passed a resolution conferring the forfeited land grant of the Marquette & Dubuque Railroad on the Marquette & Houghton Railroad Company, conditional that they shall build ten miles by the last of this year, and thirty miles by the last of next; no lands to be obtained till at least twenty miles have been built.

WANTS.

A CIVIL ENGINEER wants an engagement—Railroad construction preferred—P. O. Box 1165, Rockford, Ill

A CIVIL ENGINEER who is thoroughly educated in his profession, has had experience in field work for several years, and is especially familiar with levelling and transit surveying, desires an engagement. Address TRANSIT, at the office of the Railroad Gazette.

AN ENGINEER, who has had nearly three years' experience in the use of the instruments, in railroad location and construction, wants a situation as assistant, either in Railroad or Mining Engineering. Address ASSISTANT, Gazette Office.

SUBSCRIBERS to the Railroad Gazette who have preserved files from April 1 to Otober 1, 1870, may have this First Quarto Volume bound, at a charge of $1.50, by sending them to this office.

WANTED Every Railway Traveler in the United States and the Dominion of Canada wants every railway company to use the Thomas Safety Baggage Check. It is in use on over sixty of the best managed roads in the country and has been during the past three years, and not one piece of baggage to which this check has been attached has been lost or miscarried. Every railroad man upon whose road it is in use says:

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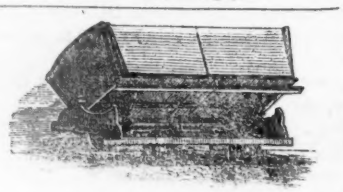

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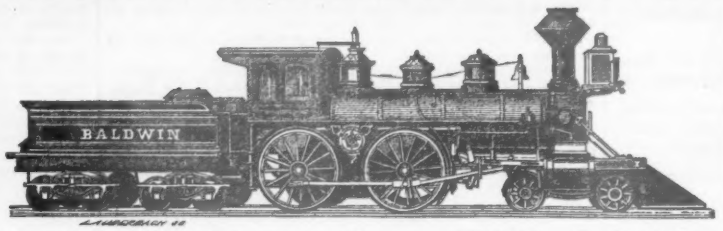

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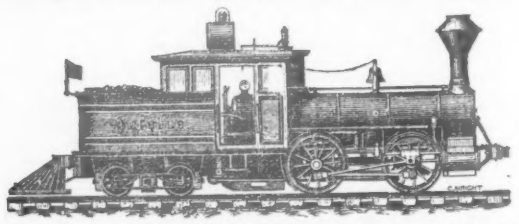

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NOTICE TO CONTRACTORS.

Proposals will be received at the office of Capt D. W. Wellman, Chief Engineer, at Menasha Wis., until

Twelve o'clock Noon, on Wednesday, March 1st, 1871,

for the Grading, Masonry and Bridging on that portion of the Portage, Winnebago & Superior Railroad lying between Doty Island and the Wisconsin River at Stevens' Point, a distance of about sixty-four (64) miles.

Proposals will be received for the work in each Section (of about one (1) mile), or for the whole work; but parties making proposals for the whole will be required to specify the prices for work on each Section.

Blank forms, setting forth the different items for which proposals will be received, will be furnished on application; and Plans, Profiles and Specifications can be seen on and after Monday, January 23d, at the office of the Chief Engineer, and at the office of the undersigned, in Ogden Building, corner Clark and Lake streets, Chicago, Ill., on and after Monday, February 6th, 1871.

Proposals, accompanied by Plans, are also invited for the Construction of the Railroad Bridge across Wolf River—to be either of Wood or Iron—consisting of one span of one hundred and fifty (150) feet, and one draw of sixty (60) feet, clear space. The bridge to be first class in every particular, and able to meet the requirements of a first-class road.

Separate proposals will also be received for the whole of the Span Bridging on the above-described work.

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It is authorized by law to accept and execute all TRUSTS of every description, in reference to both real and personal property committed to them by any person or corporation, or transferred to them by order of any of the Courts of Record, or by any Surrogate.

It is especially authorized to act as Register and Transfer agent and as Trustee for the purpose of issuing, registering or countersigning the certificates of stock, bonds or other evidences of debt of any corporation, association, municipality, State or public authority, and will pay coupons and dividends on such terms as may be agreed upon.

In giving special prominence to this department its business, attention is particularly called to the paramount advantages of employing this COMPANY in the capacity of AGENT, TRUSTEE, RECEIVER OR TREASURER, in preference to the appointment of INDIVIDUALS. A guarantee capital of ONE MILLION DOLLARS specially invested by requirement of its charter, and a perpetual succession; a central and permanent place of business, where business can be transacted daily, without disappointment or delay: its operations directed and controlled by a responsible Board of Trustees; and its entire management also under the supervision of the Supreme Court and the Comptroller of the State.

Permanency, Constant and Responsible Supervision, Guaranteed Security and Business Convenience and Facilities, may therefore be strongly urged IN ITS FAVOR on the one hand, against the Uncertainty of Life, the Fluctuations of Business, Individual Responsibility and General Inconvenience on the other.

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IMPROVED "I" BEAMS,

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THE UNION IRON MILLS manufacture all sizes of Pipe Iron, Merchant Bar, Forgings, Hammered and Rolled Locomotive and Car Axles, from the very best iron. Splice Bars (or Fish Plates,) to suit all Patterns of Rails. Bridge Iron and Bolts "I" Beams, Girder Iron, Channel Iron, &c.

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Which are both cheap and convenient. The following States are now ready: Illinois, Iowa, Missouri, Kansas, Nebraska, Minnesota, Wisconsin, Indiana, Michigan and Ohio. Mailable on receipt of 25 cents. They show the counties, towns and railroads and are fine specimens of workmanship.

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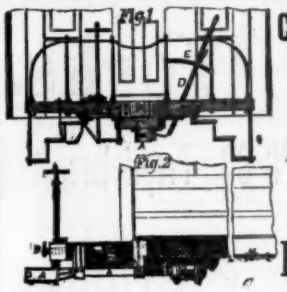

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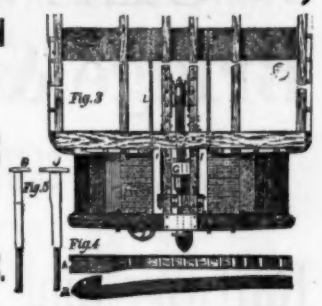
AUTOMATIC COUPLERS,

FOR

Railroad Cars.



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OFFICE—No. 231 Broadway, Rooms 4 and 5, opposite City Hall Park, N. Y.

The advantages gained by the use of these improvements may be briefly stated as follows:

1st. The platforms are held in a plane with the sills on the cars.

2d. The platforms cannot be broken by any ordinary accident.

3d. *Telescoping* is impossible.

4th. Any required compression may be attained, to prevent accidents by *oscillation*.

5th. No links and pins are required, and no one is required to go between cars to couple them.

6th. The platforms may be held as close together as desired.

7th. By close coupling the train is shortened.

8th. They will not accidentally uncouple.

9th. They may be uncoupled "*without shutting off*," to make a *flying switch*.

10th. They are strong; the train will not "*break in two*" at starting or while running.

11th. They cause the train to move steadily and not jerk in starting or stopping.

12th. They work well at great variations of hight.

13th. They will couple with all kinds of "draw-heads" and "couplers."

14th. They are cheap and durable.

15th. Injury to men when coupling cars is entirely prevented.

16th. Injury to persons by falling between cars is entirely prevented.

17th. Injury to persons and to cars by "*telescoping*" is entirely prevented.

18th. Injury to persons and to cars by "*oscillation*" is entirely prevented.

19th. The great steadiness of the cars, *produced by compression*, render sleeping cars much more desirable.

20th. "*Train Brakes*" are rendered more valuable by the non-existence of "*slack*" in the train.

☞ **No Railroad Manager who comprehends the case fails to give these improvements a "trial"! And all those who have tried them have adopted them.**

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Coupling Hooks	$24.50 each.
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Patterns in Full Sets, or Single Pieces, for all castings used in the Improvements, and Templets for Wrought Irons, AT COST. Drawings, Tracings, and superintendence of work are not charged for.

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FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
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Trains Leave Chicago from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. **MAIL AND EXPRESS**, (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. **PACIFIC FAST LINE**, (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.

☞ ELEGANT DAY COACHES and **PULLMAN PALACE DRAWING ROOM CARS** are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9.00 P. M. **PACIFIC NIGHT EXPRESS**, (Daily, except Saturday,) for Burlington, Ottumwa, DesMoines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing Room Sleeping Car** attached to this Train daily from **Chicago to Burlington,** and Elegant Day Coaches, from **Chicago to Council Bluffs and Omaha, without change!** This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

—RUNNING THE CELEBRATED—

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

7.40 A. M. **MAIL AND EXPRESS** (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Dunleith, Dubuque, La Salle, El Paso, Bloomington, &c.

10:45 A. M. **PACIFIC EXPRESS**, (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

9:00 P. M. **PACIFIC NIGHT EXPRESS**, (Daily,) with **Pullman Palace Drawing Room Sleeping Car** attached running through from Chicago to QUINCY,

Kansas City, Lawrence, Topeka and Denver,

☞ WITHOUT CHANGE! ☜

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

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WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

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Local Trains Leave { RIVERSIDE & HINSDALE ACCOMMODATION.7:00 A. M. 1:30 & 6:15 P.M
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MENDOTA PASSENGER.....4:15 P. M.
AURORA PASSENGER.....5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago at as low rates as by any other route.

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THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

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SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

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THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

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DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

This is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

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SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton,

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave Chicago from the West-side Union Depot, near Madison Street Bridge. ☜

	Depart.	Arrive.
EXPRESS MAIL	*9:15 A. M.	*8:05 P. M.
JOLIET ACCOMMODATION	*4:00 P. M.	*9:40 A. M.
NIGHT EXPRESS	†5:30 "	*12:50 P. M.
LIGHTNING EXPRESS	‡9:00 "	*7:30 A. M.

*Sundays excepted.
†Daily; Saturdays it runs to Bloomington only.
‡Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

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Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

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PASSENGERS FOR

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THE NORTH MISSOURI R. R.

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11 MILES SHORTER than any other Route!

BETWEEN

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15 Miles Shorter between ST. LOUIS and LEAVENWORTH

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50 MILES SHORTER TO ST. JOSEPH!

THAN ANY OTHER LINE OUT OF ST. LOUIS.

☞ **Three Through Express Trains Daily!** ☜

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

☞ **FOR TICKETS,** apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

JAMES CHARLTON, Gen. Pass. and Ticket Agent, St. Louis.
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THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

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THOS. McKISSOCK. General Superintendent.

ILLINOIS CENTRAL RAILROAD.

PASSENGER TRAINS LEAVE CHICAGO FROM THE GREAT CENTRAL DEPOT, FOOT OF LAKE ST.

ST. LOUIS AND CHICAGO
THROUGH LINE.

No Change of Cars from Chicago to St. Louis.

9:20 A. M. DAY EXPRESS Sundays Ex. Arriving in ST. LOUIS at 10:30 P. M.

8:15 P. M. FAST LINE. Saturdays Excepted. Arriving at ST. LOUIS at 8:00 A. M.

AT ST. LOUIS, Direct Connections are Made FOR

Jefferson City, Sedalia, Pleasant Hill, Macon, Kansas City,

LEAVENWORTH, ST. JOSEPH & ATCHISON,

—Connecting at KANSAS CITY for—

LAWRENCE, TOPEKA, JUNCTION CITY, SALINA, SHERIDAN,

Denver and San Francisco!

CAIRO, MEMPHIS AND NEW ORLEANS LINE.

No Change of Cars from Chicago to Cairo.

9:20 A. M. CAIRO MAIL, Sundays Excepted. Arriving at **Cairo** 3:05 A. M., **Memphis** 12:45 P. M., **Mobile** 9:25 A. M. **Vicksburg** 9:25 A. M., **New Orleans** 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays. Arriving at **Cairo** 13:24 P. M., **Memphis** 4:15 A. M., **Little Rock** 7:00 P. M., **Vicksburg** 8:10 P. M., **New Orleans** 1:30 A. M.

4:50 P. M. CHAMPAIGN PASSENGER, Arriving at **Champaign** at 10:45 P. M.

☞ THIS IS THE ONLY DIRECT ROUTE TO

Humboldt, Corinth, Grand Junction, Little Rock, Hot Springs, Selma, Canton, Grenada, Columbus, Meridian, Enterprise,

MEMPHIS, VICKSBURG, NEW ORLEANS & MOBILE.

At NEW ORLEANS, connections are made for

GALVESTON, INDIANOLA,

And all Parts of Texas.

☞ NOTICE.—This Route is from 100 to 150 MILES SHORTER, and from 12 to 24 HOURS QUICKER than any other.

THIS IS ALSO THE ONLY DIRECT ROUTE TO

DECATUR, TERRE HAUTE, VINCENNES & EVANSVILLE.

Peoria and Keokuk Line.

9:20 A. M. KEOKUK PASSENGER, Sun. Excepted. Arriving at **Chenoa** 3:20 P. M., **El Paso** 4:08 P. M., **Peoria** 5:42 P. M., **Canton** 7:15 P. M., **Bushnell** 8:57 P. M., **Keokuk** 11:15 P. M., **Warsaw** 11:40 A. M.

Elegant Drawing Room Sleeping Cars

ATTACHED TO ALL NIGHT TRAINS.

Spacious and Fine Saloon Cars!

WITH ALL MODERN IMPROVEMENTS, RUN UPON ALL TRAINS.

BAGGAGE CHECKED THROUGH TO ALL IMPORTANT POINTS.

☞ For Through Tickets, Sleeping Car Berths, Baggage Checks, and information, apply at the office of the Company in the Great Central Depot, foot of Lake St.

Hyde Park and Oakwoods Train.

	LEAVE	ARRIVE		LEAVE	ARRIVE
HYDE PARK TRAIN,...	*6:20 A. M.	*7.45 A. M.	HYDE PARK TRAIN,....	*3:00 P. M.	*5:15 P. M
HYDE PARK TRAIN...	*8:00 A. M.	*9.30 A. M.	HYDE PARK TRAIN,....	*6:10 P. M.	*7:35 P. M
HYDE PARK TRAIN,..	*12:10 P. M.	*1:45 P. M.			

* Sundays Excepted.

W. P. JOHNSON, Gen. Pass. Agent. M. HUGHITT, Gen. Supt.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:30 A. M. Clinton Passenger. | **10:00 P. M.** Night Mail.
10:45 A. M. Pacific Express. | **10:00 P. M.** Rock Island Pass.
10:45 A. M. Rock Island Exp. | **4:00 P. M.** Dixon Passenger.

For Sterling, Rock Island, Fulton, Clinton. Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	65.00	" SAN FRANCISCO,	5	118.00

TRAINS ARRIVE:—Night Mail, 7.15 a. m.; Dixon Passenger, 11.10 a. m.; Pacific Express 4:15 p. m.; Rock Island Express, 4:15 p. m.; Clinton Passenger, 6:45 p. m.

FREEPORT LINE.

9.00 A. M. & 9.00 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.
4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, 2:30 p. m., 6:40 a. m.; Rockford Accommodation, 11:10 a. m.; Geneva and Elgin Accommodation, 8:45 a. m.; Junction Passenger, 8:10 a. m.; Lombard Accommodation, 6:50 a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. DAY EXPRESS, for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.
3.00 P. M., Janesville Accommodation.
5.00 P. M. NIGHT EXPRESS, for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.
5.30 P. M., Woodstock Accommodation.

TRAINS ARRIVE:—7:00 a. m., 7:15 p. m., 9:00 a. m., and 2:05 p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,	8:15 A. M.
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,	9:45 A. M.
EVANSTON ACCOMMODATION,	1:00 P. M.
HIGHLAND PARK PASSENGER,	6:20 P. M.
MILWAUKEE ACCOMMODATION, with Sleeping Car attached	11:00 P. M.
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot	4:10 P. M.
AFTERNOON PASSENGER,	5:00 P. M.
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot	5:30 P. M.

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, 5:00 a. m.; Day Express, 4:15 p. m. Milwaukee Mail, 10:30 a. m.; Afternoon Passenger, 7:40 p. m.; Waukegan Accommodation, 8:25 a. m.; Kenosha Accommodation, 9:10 a. m.; Evanston Accommodation, 3.30 p. m.; Highland Park Passenger, 7.55 p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt. **JOHN C. GAULT,** Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night Trains, a full night's rest in Palace Sleeping Cars.

☞ BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY! ☜

PASSENGERS FROM CHICAGO can obtain these Advantages only by he MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R'Y.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets **TO MILWAUKEE,** as this is the Great Distributing Point for these States.

A. V. H. CARPENTER, Gen. Pass. Agt. Milwaukee. **S. S. MERRILL,** Gen. Manager, Milwaukee

61 Miles the Shortest Line!

— FROM —

CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago

— AND —

PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains THROUGH to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG,

PHILADELPHIA & NEW YORK,

☞ WITHOUT CHANGE! ☜

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD, SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

☞ Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

	Mail.	Fast Express.	Pacific Exp.	Night Exp.
Leave—CHICAGO	5.30 A. M.	9.00 A. M.	5.15 P. M.	9.00 P. M.
Arrive—PLYMOUTH	9.50 "	12.03 P. M.	8.45 "	12.35 A. M.
" FORT WAYNE	12.30 P. M.	2.05 "	11.15 "	3.10 "
" LIMA	3.24 "	4.06 "	1.33 A. M.	5.40 "
" FOREST	4.43 "	5.08 "	2.45 "	7.07 "
" CRESTLINE	6.30 "	6.30 "	4.30 "	8.55 "
Leave—CRESTLINE	6.00 A. M.	6.50 "	4.30 "	9.35 "
Arrive—MANSFIELD	6.40 "	7.17 "	5.00 "	10.05 "
" ORRVILLE	9.15 "	9.05 "	6.54 "	11.55 "
" ALLIANCE	11.10 "	10.40 "	8.30 "	1.30 P. M.
" PITTSBURGH	3.45 P. M.	1.55 A. M.	12.10 P. M.	4.40 "
" CRESSON	11.57 "	5.44 "	4.48 "	10.00 "
" ALTOONA	12.48 A. M.	6.55 "	5.55 "	2.40 A. M.
" HARRISBURG	5.30 "	11.25 "	10.45 "	2.50 "
" PHILADELPHIA	6.50 "	3.15 "	3.00 "	6.50 "
" NEW YORK, VIA PHILADELPHIA	10.30 "	6.30 "	6.41 "	10.30 "
" NEW YORK, VIA ALLENTOWN	10.30 "	6.30 "	.....	10.30 "
" BALTIMORE	9.15 P. M.	3.05 "	2.30 A. M.	9.15 P. M.
" WASHINGTON	1.00 "	5.15 "	5.45 "	1.00 "
" BOSTON	9.00 "	5.50 A. M.	6.00 "	9.00 "

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of Seeing the FINEST VIEWS AMONG THE ALLEGHANY MOUNTAINS,

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

☞ All New England Passengers holding Through Tickets will be Transferred, with their Baggage, to Rail and Boat Connections in NEW YORK, **Without Charge!**

THROUGH TICKETS for sale at the Company's Offices, at 65 Clark St.; 52 Clark St.; cor. Randolph and LaSalle Sts.; and at Depot, Chicago. Also at Principal Ticket Offices in the West.

CLOSE CONNECTIONS Made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES,

The Most Perfect Protection Against Accidents in the World!

F. R. MYERS, Gen. Pass. & Tkt Agt. P. F.W. & C. R'y Chicago. | **W. C. CLELAND,** Gen. Western Pass. Agt. P. F. W. & C. R'y, Chicago.

T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track!

ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!

From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

☞ The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,

NEW YORK, ALBANY, BOSTON, PROVIDENCE,

AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

☞ **SLEEPING COACHES,** Combining all Modern Improvements, with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the **BROAD GAUGE,** accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, **wait from one to two hours for Western trains.**

All Trains of Saturday run directly Through to New York.

☞ **Ask for Tickets via Erie Railway,** which can be procured at **66 Clark Street** Chicago, and at all Principal Ticket offices in the West and Southwest.

L. D. RUCKER, Superintendent New York. | **A. J. DAY,** Western Passenger Agent, Chicago. | **WM. R. BARR,** Gen'l Passenger Agent, New York

Pan-Handle

— AND —

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO ☜

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 20th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS. [SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS.... 3:00 A. M.	HARRISBURG..10:35 P. M.	NEW YORK.... 6:40 A. M.	WASHINGTON..5:45 A. M.
PITTSBURGH..12:15 M.	PHILADELPHIA 3:10 A. M.	BALTIMORE.... 2:30 A. M.	BOSTON.....5:05 P. M.

7:10 P. M. NIGHT EXPRESS. [SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS...11:15 A. M.	HARRISBURG.. 5:20 A. M.	NEW YORK...11:40 A. M.	WASHINGTON. 1:10 P. M
PITTSBURGH.. 7:25 P. M.	PHILADELPHIA.9.30 A. M.	BALTIMORE... 9:30 A. M.	BOSTON.....11:30 P. M

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati.
18 Miles the Shortest Route to Indianapolis and Louisville

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Wheeling, Parkersburg, Evansville, Dayton, Zanesville, Marietta, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7.40 A. M. (Sundays excepted) Arriving at

LOGANSPORT	1:15 P. M.
KOKOMO	2:33 P. M.
CINCINNATI	10:10 P. M.
INDIANAPOLIS	5:00 P. M.
LOUISVILLE	11:30 P. M.

8.05 P. M. (Saturdays excepted.) Arriving at

LOGANSPORT	1:15 A. M.
KOKOMO	2:31 A. M.
CINCINNATI	9:35 A. M.
INDIANAPOLIS	5:40 A. M.
LOUISVILLE	3:30 P. M

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

☞ Ask for Tickets **via COLUMBUS** for the East, and **via "The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus. **I. S. HODSDON** Northwestern Pass. Agt. Chicago.

D. W. CALDWELL Gen. Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

☞ THROUGH LINE! ☜

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,

— AND —

NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIRECT CONNECTION at **OMAHA** with the Great **Union Pacific Railroad,** for

CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO

And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

☞ Ask for Tickets via the People's Favorite Route, **Kansas City, St. Joseph & Council Bluffs Railroad Line.**

A. L. HOPKINS, Gen. Superintendent ST. JOSEPH, Mo. **A. C. DAWES,** Gen. Passenger Agent, ST. JOSEPH, Mo.

LAKE SHORE
— AND —
MICHIGAN SOUTHERN R.W.

THE GREAT THROUGH LINE BETWEEN

CHICAGO, BUFFALO & NEW YORK,

WITHOUT CHANGE!

AND THE ONLY RAILWAY

RUNNING PALACE COACHES THROUGH!

— BETWEEN —

CHICAGO & NEW YORK, via BUFFALO

☞ WITHOUT TRANSFER OF PASSENGERS! ☜

All Trains Stop at Twenty-Second Street to Take and Leave Passengers. Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave Chicago from the New Depot, on Van Buren St., at the head of La Salle Street, as follow

5:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 22d Street 7:45 A. M. Stops at all Stations. **Arrives**—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS,
VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, **9:15 A. M. Arrives**—Elkhart, 12:45 P. M.; Cleveland 9:45 P. M.; Buffalo, 4:10 A. M.; New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running

THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.

Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily),
VIA OLD ROAD.

Leaves—Twenty-Second Street **5:30 P. M. Arrives**—Laporte, 8:10 P. M. (Stops 20 minutes or Supper); arrives at Toledo, 2:50 A. M.; Cleveland, 7:25 A. M. (20 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (30 minutes for Supper); connects with **Sleeping Coach running Through from Rochester to Boston Without Change,** making but **One Change between Chicago and Boston.**

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives at NEW YORK, 7:15 A. M.

9:00 P M. NIGHT EXPRESS
VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, **9:15 P. M. Arrives**—Toledo, 6:15 A. M. (20 minutes for Breakfast); arrives at Cleveland, 10:50 A. M.; Buffalo, 5:50 P. M.; New York, 12:00 M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.; Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.; Grand Rapids, 10:15 A. M.

☞ There being no heavy grades to overcome, or mountains to cross, the road bed and track being the smoothest and most perfect of any railway in the United States, this Company run their trains at a high rate of speed with perfect safety.

☞ Travelers who wish to SAVE TIME and make SURE CONNECTIONS, purchase Tickets via

LAKE SHORE & MICHIGAN SOUTHERN R'Y.

THE ONLY LINE RUNNING THROUGH BETWEEN CHICAGO AND BUFFALO, WITHOUT TRANSFER, and in Direct Connection with NEW YORK CENTRAL RAILROAD and ERIE RAILWAY.

General Ticket Office for Chicago, No. 56 Clark Street.

CHAS. F. HATCH,
General Superintendent, CLEVELAND, OHIO

F. E. MORSE,
General Western Passenger Agent, CHICAGO.

GREAT CENTRAL ROUTE!

SPEED! COMFORT! SAFETY!

MICHIGAN CENTRAL
— AND —
Great Western Railways.

THE FAVORITE ROUTE, VIA NIAGARA FALLS, TO

NEW YORK, BOSTON,

AND ALL EASTERN POINTS.

Pullman's Drawing-Room Cars

FROM CHICAGO TO NEW YORK WITHOUT CHANGE.

CELEBRATED HOTEL CARS FROM CHICAGO TO ROCHESTER.

Passenger Trains leave Chicago from Depot, foot of Lake Street, as follows: (All Trains Stop at Twenty-Second Street Station to receive and leave Passengers.)

5:40 A. M. MAIL TRAIN, Sundays Excepted.
Has a car attached from Chicago going over both Main Line and Air Line Division, Without Change. Connects at New Buffalo for St. Joseph; at Kalamazoo for Grand Rapids, Muskegon and Whitehall; at Jackson for Lansing, Saginaw and Bay City.

9:00 A. M. NEW YORK EXPRESS.
(SUNDAYS EXCEPTED.) Arrives at Michigan City at 11:10 A. M.; Niles, 12:20 P. M. [Dinner]; Kalamazoo, 2:10 P. M.; Marshall, 3:24 P. M.; Jackson, 4:30 P. M.; Detroit, 6:55 P. M. [Supper]; London, 11:25 A. M.; Hamilton, 2:35 A. M.; Niagara Falls, 4: A. M.; Rochester, 7:10 A. M. [Breakfast]; Albany, 2:00 P. M.; NEW YORK, **7:00 P. M.**; Springfield, 7:40 P. M.; BOSTON, **11:45 P. M.** This Train connects at ROCHESTER with

WAGNER' DRAWING-ROOM CAR THROUGH

To New York City Without Change!

9:30 A. M. CINCINNATI & LOUISVILLE EXPRESS
(SUNDAYS EXCEPTED.) **Through Cars to Indianapolis and Cincinnati without Change.**

4:10 P. M. Kalamazoo, St. Joseph and Three Rivers Accom.
(SUNDAYS EXCEPTED.) Arrives at New Buffalo at 7:05 P. M.; St. Joseph, 8:40 P. M.; Kalamazoo, 1:05 P. M.; Three Rivers, 10:00 P. M.

5:15 P. M. ATLANTIC EXPRESS.
Leaves Daily. ☞ Arrives at Michigan City at 7:18 P. M.; Niles, 8:30 P. M. [Supper]; Kalamazoo, 10:40 P. M.; Jackson, 1:10 A. M.; Detroit, 3:45 A. M.; London, 8:35 A. M. [Breakfast]; Hamilton, 11:40 A. M.; Niagara Falls, 1:30 P. M.; Buffalo, 3:20 P. M.; Rochester, 5:10 P. M.; Albany, 1:30 A. M.; NEW YORK, **6:40 A. M.**; Springfield, 6:40 A. M.; BOSTON **11:00 A. M.** A MAGNIFICENT

PULLMAN DRAWING-ROOM SLEEPING CAR

IS ATTACHED TO THIS TRAIN DAILY, FROM

CHICAGO TO NEW YORK CITY.

☞ The Celebrated **HOTEL CAR** is also Attached to this Train from **CHICAGO** to **ROCHESTER.**

☞ **SPECIAL NOTICE.**—Boston and New England Passengers will please notice that thi Train now makes a direct connection through. A **Sleeping Car** is attached at Rochester at 5:30 P. M., running through to Springfield, Mass., thus avoiding transfer at Albany. Breakfast at Springfield. This Train reaches Springfield early enough second morning to CONNECT WITH ALL TRAINS up and down the Connecticut

6:05 P. M. CINCINNATI & LOUISVILLE EXPRESS
(SATURDAYS EXCEPTED.) **Through Sleeping Cars to Louisville without Change.**

This is the Only Line Running Sleeping Cars to Louisville!

9:00 P. M. NIGHT EXPRESS. Saturdays and Sundays Excepted
☞ Arrives at Michigan City at 11:03 P. M.; Niles, 12:25 A. M.; Kalamazoo, 2:00; Marshall, 3:12; Jackson, 4:25; Grand Trunk Junction, 7:00; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 5:40; Buffalo, 7:15 P. M.; Rochester, 9:10; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 2:25; Albany, 6:50 A. M.; NEW YORK, **12:00 M.**; BOSTON, **3:30 P. M.**

A PULLMAN PALACE SLEEPING CAR

Is attached to this Train for **DETROIT.** This Train connects at **DETROIT JUNCTION** with **Grand Trunk Railway** for

MONTREAL, OGDENSBURG, &c.

9:00 P. M. Grand Rapids Express.
(SATURDAYS AND SUNDAYS EXCEPTED.) Arrives at Grand Rapids at 9:50 A. M.

An Elegant Pullman Sleeping Car

IS ATTACHED TO THIS TRAIN

THROUGH TO GRAND RAPIDS WITHOUT CHANGE!

Connecting there Direct to MUSKEGON, WHITEHALL, &c., &c.,

SPECIAL NOTICE.—The GREAT WESTERN RAILWAY of Canada have during the past summer, put down 140 miles of New Rail, (a large proportion of the same being Steel Rails,) and otherwise improved their track, so that it can be truly said that it is in as good condition as any Line in the country.

☞ **Through Tickets** (and secured accommodations in Drawing-Room Sleeping Cars) can be purchased in Chicago at **60** Clark street (under Sherman House); at **48** Clark street (Grand Trunk Railway); at **53** Clark street (N. Y. C. R. R.); at office under Briggs House; at Great Central Depot, and at

General Office in Tremont House Block.

H. E. SARGENT,
Gen. Sup't M. C. R. R.

W. K. MUIR,
Gen. Sup't Gt. W. R'y.

HENRY C. WENTWORTH
Gen. West. Pass. Agt. M. C. & Gt. W. R'y